

ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

Edited by

LEWIS STEPHEN PILCHER, M.D., LL.D.
of New York

With the Collaboration of

SIR WILLIAM MACEWEN, M.D., LL.D.
of Glasgow

SIR W. WATSON CHEYNE, C.B., F.R.S.
of London

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THE PLACE OF RADIUM IN SURGERY

BY EDWARD M. FOOTE, M.D.

OF NEW YORK

CLINICAL PROFESSOR OF SURGERY, NEW YORK POLYCLINIC MEDICAL SCHOOL; SURGEON TO THE
NEW YORK SKIN AND CANCER HOSPITAL

RADIUM's place in the treatment of tumors is still an uncertain one. Ten years' experience with it on the part of many experimenters, hundreds of articles in the medical press, even the monthly issue of several special journals, the publication of many books and endless discussions in medical society meetings have not resulted in fixing its value with any degree of definiteness.

At the present time there are some men who say that it has little or no value; while there are others who believe that it is destined to take the place of the knife in the treatment of tumors. Between these two extremes are scattered the opinions of the majority of surgeons, but these opinions have not yet grouped themselves around generally accepted truths. Herein lies the excuse for adding one more to the already formidable list of articles upon this subject. An extremist may continue to be an extremist in spite of the weight of evidence; for there are men so constituted that they always see what they are looking for. Men of slower decision must hunt through this overwhelming mass of testimony again and again, gradually building up a pile of definitely proved facts while spreading out for further inspection a great number of interesting possibilities.

In a review of this character it is unnecessary to refer to the technicalities of radium treatment; but one cannot too strongly urge upon all who write reports of cases, the great desirability of an exact description of patient and treatment. Wood states that there are only three factors of importance in the action of radium on tumor tissue: viz., time of exposure, dosage of radium and the distance between the radium and the tumor. In any report these data should invariably be given, as well as the nature of the tumor, its position and its bulk as nearly as

this can be ascertained by surface measurements and by palpation. The surface diameters should be given in inches or centimetres and the depth estimated by palpation or otherwise and expressed in the same scale. It is surprising how loth the medical profession is to give up the habit of describing tumors in terms of the vegetable kingdom. "As big as a hickory nut" or "the size of an orange," and similar expressions still find their way into descriptions where accuracy is of prime importance.

When I first began a review of the reports on radium published in the last two years, I thought it might be possible to summarize them so as to draw fairly definite conclusions. The indefiniteness of statement in these reports, and especially in the reports from individuals, makes any such summary impossible; but there is reason to hope that within a comparatively short time, some generalizations may be possible in connection with the reports from radium institutions. For example, the radium institute of London has published its reports for 1912, 1913, and 1914. This institution is said to deal only with inoperable cases. Omitting the patients who were seen but not treated, the totals for these three years were 539, 654, and 594, of which the cures and apparent cures numbered the first year about 15 per cent., the second and third years about 11 per cent. of the totals. Possibly the war may have had some effect on the number of persons applying for treatment in 1914. If not, and no other local cause existed to explain the very small increase in attendance, it seems a fair inference that the patients treated were not very favorably impressed with the results. A few more annual reports will bring this point out more clearly. It is absolutely certain that the future of any new method of treatment depends far more on what the patients think of it than it does on what the doctors think of it.

Will radium gain for itself a broad place in the field, such as that gained by plaster-of-Paris in the treatment of fractures? Or will its place be a limited one in the hands of only a few enthusiasts, such as that held by hydrotherapy? Or will it pass into practical disuse as blood-letting has done? Only the future can answer this definitely, but we can already see some of the conclusions upon which that future judgment will rest.

One of the generally accepted facts about radium is its ability to destroy tumor tissue. The way in which this is accomplished has given rise to much discussion, out of which has arisen the theory of the "selective action of radium." Some men have denied that it has a selective action upon the tumor cell; but most of those who have considered this question admit that it exists in some form. For practical

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purposes it makes little difference whether the radium attacks the tumor cells simply because they are less resistant than the normal cells of the body; or whether there is some really "selective action" in the stricter sense of the word. One writer has even suggested that the influence of radium upon cancer cells produces antibodies which may be useful in causing the disappearance of metastatic nodules, but this is pure speculation.

If then radium has a destructive effect upon tumor tissue "selective" to the extent of sometimes causing its disappearance while injuring the normal tissue only temporarily, the next important question to be settled is this, "What kind of tumors are susceptible to its influence?" Nearly every writer gives a different answer to this question, but there are a few points of agreement nevertheless. It is generally admitted that radium causes the disappearance of keloids, which may be called tumors by courtesy, of lymphangiomata and of basal-celled epitheliomata in very early stages or if they are superficial. All of these growths, it may be noticed in passing, are either on the surface or so near to it that only a thin layer of skin intervenes between the radium and the normal cells. Beyond this general statement, there are instances reported by different writers of the disappearance after exposure to radium of almost every kind of tumor in almost every part of the body; but thus far no rule has been discovered by which the effect of radium in any particular case can be predicted with certainty.

There is, however, one group of tumors in which success has frequently been noticed, and another in which failure from treatment has been very generally admitted. In the first group should be placed the sarcomata and in the second group the prickle-celled epitheliomata. The rapidity with which one sarcoma will destroy the human body, while another is driven out by some apparently inadequate cause (for example Coley's fluid), forms a riddle which medical science has not yet solved. It is not to be wondered at that the behavior of these tumors to radium is therefore variable. Even a melanotic sarcoma of multiple form has been said to disappear after the use of radium as if by magic.

The resistance of prickle-celled epitheliomata may be due to their vitality or their tendency toward rapid growth away from the surface. The failure of radium to stop their growth has also been attributed to the situation of these tumors within the mouth or other cavities of the body where the prolonged use of radium produces an unbearable irritation.

In another group of tumors radium has frequently been employed, and as some have claimed, with great success; although these claims have

been disputed by others. These are tumors of the cervix and body of the uterus and tumors of the ovaries. The admitted facts in this connection are the production of amenorrhœa, the drying up of foul vaginal discharge and the cicatrization of ulcers. The skeptics claim that this is the sum total of the effect of radium in these cases. There is no doubt of the artificial sterility produced in these patients by the use of large doses of radium repeatedly applied for several hours at a time. It is also produced in the nurses who have to wait on the patients during the attacks of nausea caused by the radium treatment.

This amenorrhœa is sufficient to check the hemorrhage from uterine fibroids and probably sufficient to explain the partial shrinkage in the tumors which sometimes occurs. Similar changes sometimes take place at the normal menopause. But it seems a little far-fetched to explain the disappearance of cancer of the cervix, much less of the body of the uterus, as due to this artificial sterility, for no such phenomenon takes place at the normal menopause; yet there are not wanting men who claim to have effected repeatedly the cure of cancer which extended well into the pelvis. Perhaps the present attitude of conservative men who regard radium favorably is fairly stated by Ransohoff, who advises operation in operative uterine cases, but uses radium to stop the discharge and hemorrhage and destroy the cauliflower masses, when these symptoms develop in inoperable cases. The improvement of symptoms which results is in most cases only temporary.

Another important point in connection with radium treatment is how to decide when radium has effected a cure. In the scar tissue which takes the place of the apparently cured cancer, the microscope may reveal islands of cancer cells. Their vitality may be destroyed or they may be only dormant, depending upon the action of the radium. If such uncertainty exists in every apparently cured case, one will naturally hesitate to substitute radium for operation in operable cases, unless the tumor is so situated that it is worth taking some risk of recurrence to avoid the mutilation caused by operation. It may be that further experience will definitely determine to what depth tumor cells have been influenced beyond the possibility of re-growth; so that one may be as sure of their destruction for a given distance as if they were actually removed by operation.

The determination of the dosage of radium rests of necessity in the hands of those who use it; but anyone can enjoy the humor of the situation when the possessors of one hundred milligrammes or more of the precious element object to treatments being made by the men who have only ten or twenty milligrammes, on the ground that small quantities are

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liable to stimulate tumor growth and so do more harm than good. Meanwhile the owners of small amounts are publishing their striking successes with no less fervor than their wealthier brothers. If it is a question of veracity who shall decide between them? It is a good suggestion, and one well worthy of endorsement, that the owners of radium should be officially registered, and the amount of their radium should be recorded.

It seems very unlikely that a patient having secondary cancerous nodules in lymph-glands or elsewhere can be cured by radium. We have been repeatedly told that its influence after penetrating an inch of tissue is practically *nil*. A palpable metastatic nodule will often be near the surface, but by the time it is recognizable for radium treatment there are almost sure to be other metastatic nodules in other places, some of them quite inaccessible for recognition or treatment.

How explain then the reported instances of disappearance of cancer when lymphatic glands were involved?

There are three possible explanations: First, lymph-glands are often enlarged from other causes. Almost everybody has palpable lymph-glands in some situation. Second, ulcerative cancers often produce enlargement of the regional glands, when if these glands are examined microscopically it will sometimes be found that they are enlarged as a result of inflammation and are not cancerous at all. Third, in some cases even non-ulcerating cancers may be sufficiently irritating to produce glandular enlargement. If, therefore, a patient with a cancer and enlarged regional glands has been treated with radium with disappearance of cancer and glands it is not safe to assume that radium has cured metastases, unless at least one gland was previously removed and found to be cancerous, as might be the case if the patient were treated for postoperative recurrence.

This brings us to the last question and perhaps the most important of all. Shall a patient having cancer in operable condition be advised to have an operation or treatment by radium?

A fair answer to this question based on the published articles seems to be that operation should have the preference in cancer so situated that operation gives a fair chance of cure. In the present state of our knowledge, I think a man does his patient a grave injustice if he advises radium for a primary prickle-celled epithelioma, or for any primary cancer of considerable bulk, if the conditions are favorable for its removal.

Primary basal-celled epitheliomata of the face, lymphangiomata, and fibroids of the uterus, angiomas and keloids may all be safely

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treated with radium. In the case of large rapidly growing tumors, sarcomatous or otherwise, so situated that operation is likely to prove unsuccessful or to have a high mortality, radium may be tried; but the proper place to test it is still in the recurrences. Many of them are situated near the surface, so that radium has the best opportunity for its action, and the investigator can determine the effect of treatment by inspection, palpation and measurement, and can remove tissue for microscopic examination from time to time. This is the proper field for research and it can be carried out without taking away some patient's best chance of a cure by surgical removal of his tumor.

When the investigator in radium becomes so expert that he can say with definiteness, "Here is such and such a type of tumor and its bulk is approximately so and so. I know from experience that I can cause its entire disappearance with so much radium applied for so many hours," it will be time enough to advise radium in primary operable cases.

INTRATHYROID INJECTIONS OF BOILING WATER IN HYPERTHYROIDISM

BY J. CHRIS O'DAY, M.D.
OF PORTLAND, OREGON

WHEN Professor Miles F. Porter hit upon the idea of injecting boiling water into the thyroid gland for the relief of the distressing symptoms of hyperthyroidism, he could have had but one thing in mind for the injection to accomplish—namely, the destruction of the secreting epithelium of the acini.

Before venturing an experimental try out of his very unique idea upon the human subject, also that a reliable estimate of its effectiveness be known, the thyroids of a number of dogs were injected, subsequently extirpated and sectioned. Some of the experiments were carried on by Dr. W. D. Gatch of the Indiana University School of Medicine.

From the experiments on animals it was demonstrated that (1) the procedure is a safe one, (2) the immediate effect of the injection of boiling water was destruction of the gland-cells and colloid which is later replaced by connective tissue, and (3) a goitre in the dog can, by this means, be cured permanently.

Adhering to the technic evolved during the animal experiments, he injected hyperthyroid goitres at his clinic, where attaining similar results the method was recognized as a worthy and very effective surgical procedure.

Before publishing his first paper on the subject, in a personal letter, he very kindly called my attention to the matter, and after a detailed description of the technic, suggested my giving it a trial should opportunity for such treatment present itself. During the year which followed I was able to add four cured cases to the credit of this means of treatment. These four cases were treated during the year 1913, and while they represented my first experience with Porter's method, three have remained free from recurrence of the symptoms, while the other one, whose goitre was small, submitted to a partial thyroidectomy which resulted in a complete and so far permanent cure. In his paper on the subject (*Surgery, Gynecology and Obstetrics*, January, 1915) in a summary of the clinical experience, Porter says, "This covers over one hundred cases, some of which were in my own practice, but the majority in the practice of other surgeons. I am especially

J. CHRIS O'DAY

indebted to Dr. Robert T. Morris, of New York, Dr. Wayne Babcock, of Philadelphia, and Dr. J. C. O'Day, of Portland, Oregon, for their kindness in reporting to me the results of their work. There have been no deaths or serious results reported from the treatment. Dr. Babcock reports (personal letter) a fatality following the injection of hot water as follows:

"A patient who seemed in fair condition was brought to the operating room for ligation or lobectomy, when she became intensely excited and the pulse rate increased from about 130 to 170. The patient was nearly maniacal from the excitement. The operation therefore was not attempted and one lobe was injected with boiling water and the patient returned to bed. Tachycardia and excitement continued and three or four days later the patient died."

In so far as I have been able to learn, this represents the only undesirable experience occurring in relation with this very valuable treatment of thyroid intoxication, yet, to those who have had much to do with the treatment of this disease, it must be apparent that similar fatalities have occurred, and in precisely the same manner, long before Porter had given us his method of boiling water injections.

In our cases so treated, numbering seventeen in all, nothing but good has resulted, even those first treated, when lack of experience was accompanied by its corresponding undeveloped technic.

While the particular experience of Dr. Babcock's was a sorry one, it will serve admirably to force home one of the greatest uncertainties with which we have to deal in the treatment of hyperthyroid goitre. Let me assume in this way—our seventeen cases yielded because the thyroid intoxication had not progressed to the degree of producing pathological changes in any of the vital tissues. With Dr. Babcock's case, we may justly assume, this change had occurred. But how are we to differentiate the two? There are a number of such unfortunate cases that come to the thyroid surgeon where, to quote the distinguished Chas. H. Mayo, "The best one can do is to wish them (the goitres) out." We have merely to remind ourselves of the difficulties besetting every diagnostic means, when we try to deduce facts from an individual whose body is already overburdened in beating back the fury of a thyroid storm.

With every guide swept away, chaos where there should be order, catching the last faint call for help, in the dark, we throw a life line, but too late, they go down. A buoy and not a life line was needed.

INTRATHYROID INJECTIONS OF BOILING WATER

There is such a variance of opinion throughout the medical world concerning the treatment of hyperthyroid goitre that prevailing conditions are not to be wondered at. If, however, one will go carefully into the records of such observers as Crile, Murphy, Mayo, Porter, Halsted, etc., it would seem that our present vaudeville style of treatment would yield to one which has for its purpose the reducing of the gland's power of secretion. But until such a general dissemination of knowledge has been obtained, the thyroid surgeon must expect to encounter cases in every possible degree of severity.

We must be taught here, as in many other surgical diseases, the creed of early recognition, and once the lesson has been learned such experiences as that reported by Dr. Babcock will grow markedly less.

We have merely to remember that such measures as preliminary ligation (Kocher), nerve blocking (Crile), artificial cedema (O'Day), and injections of boiling water (Porter) were each begotten in the spirit of a conservatism born of just such fatalities as the one mentioned above. When the existing conditions are still within the possibilities of safe surgery, partial thyroidectomy is, without doubt, the procedure of choice. It gives the very best results. It is only after this period has passed that we are compelled to consider the application of one of those measures which has for its object the bringing of the sufferer back to where surgery can be safely applied. Here it is where the injections of boiling water will be of the greatest value. Indeed, some of the patients have been so relieved that operation was refused. Porter reports similar occurrences.

While the injections of boiling water meet every requirement of the principle involved—namely, the destruction of the gland's acini—we have been taught to recognize the value of Crile's ano-association when applied jointly, particularly is this true in extreme cases.

During the time the gland is being destroyed, piecemeal, by each succeeding injection of the hot water, one cannot afford to include neglect of other beneficial measures. Prominent among which rest and quiet are most effective. The environment of silence with which we unfailingly surround our tetanus patients may, with equally as much logic, be given to those who are suffering the continuous drive of a toxic goitre. Taking this view of the facts involved we must immediately become impressed with the great truths set forth by Crile in his "Kinetic Drive and Ano-association." With all these factors in mind and properly applied, "wishing the goitre out" will, in many instances, become a realization.

To tell any individual you are about to inject boiling water into his neck is no welcome piece of news. The mere suggestion of it cannot fail in making a rather unpleasant impression. What then should be expected from an individual whose whole nervous system has been thrown into the attitude of extreme fright from a toxic goitre? By exercising a little tact, saying nothing about the boiling water injections, beginning with a small needle, using morphine merely hypodermically at first, feeling one's way cautiously into the patient's confidence, will produce results not likely to be accomplished in any other way.

That no fumbling occurs while the hot water is being injected, three or four rings cut from large rubber tubing are slipped over the barrel of a 10 c.c. glass syringe; wearing two pairs of gloves, cotton inside of rubber, the operator is enabled to work without fear of burning his hands. From the time the syringe is lifted out of the sterilizer till the water has been injected, no time must be lost, for unless the water be hot enough to cook the tissue into which it is injected its purpose will be defeated.

Before the process of "cooking" has begun, the surgeon should have definite plans at hand for the attack. Remembering the good results obtainable by the Stamm-Jacobson operation of ligating the superior poles, we are now in the habit of beginning the cooking at the upper pole, each succeeding injection being carried downward, the needle point being so directed at each selected level that the destruction of the gland is wrought in strata. Unless some such order is maintained, one may be unconsciously reinjecting the same point, thereby hindering the systematic part by part destruction necessary in securing satisfactory results. When the gland is small, making the injections more or less uncertain, unless the condition of the patient be very severe, we have been able to obtain splendid results by exposing the thyroid and cooking it directly under the eye. This can be accomplished without elaborate preparation, under local anæsthesia. With the gland exposed in this way the effectiveness of the process can be fully appreciated. As the boiling water is being injected, the corresponding portion of the gland is seen to whiten into a bloodless, pulp-like mass.

THE TREATMENT OF BONY DEFECTS OF THE LOWER JAW*

By CLARENCE A. McWILLIAMS, M.D.

OF NEW YORK

THE author is convinced that no surgical lesion is generally so badly treated as infection and osteomyelitis of the inferior maxilla. This is due in the first place to timidity and ignorance on the part of the dentist who sees these patients in the beginning. His ill-advised attempts to save abscessed teeth lead to more or less widespread necrosis of the jaw. Secondly, the general surgeon frequently attacks the necrosed area with the curette and chisel with too great vigor, thus increasing the necrosis by trauma.

To particularize a little further, the dentist should not attempt to save badly broken-down teeth by putting on full-grown crowns embracing the entire root beneath the gums, as this is a potent cause of pyorrhœa. Such teeth should be extracted before abscesses develop. In case an abscess has occurred, no delay should be followed in removing the abscessed tooth. If the abscess is simply around the root of the tooth and has not invaded the gum, extraction may be all that is necessary. If the infection has had time to invade the bone, the abscess will not be aborted by simple extraction of the tooth. How often patients say "My dentist would not extract the tooth until the swelling went down!" With most dentists this seems to be an axiom. Every so-called "gum boil" should first have the tooth extracted, this to be immediately followed by a good, free incision along the alveolar process directly over apex of infected tooth, following infiltration of the gum with 2 per cent. novocaine solution. If free drainage is not obtained, an incision should be made under the inferior maxilla at point of fluctuation, parallel with inferior border of maxilla. By early extraction and free incision inside the mouth, the acute condition is usually controlled.

The treatment of chronic osteomyelitis of the lower jaw should consist chiefly in establishing and maintaining good drainage and in free, frequent irrigations through the sinuses, which should be frequently probed to ascertain whether or not free sequestra are present. The surgeon should resist the first impulse to vigorously curette these sinuses, as by this means it is very easy for him to increase the area of the necrosis by injuring the delicate new bone cells that are forming

* Read before the New York Surgical Society, January 24, 1917.

in the osteogenetic, periosteal layer. A waiting policy should be adopted, allowing nature herself to make the separation of dead from living bone. The periosteum should not be traumatized by the curette and should always be preserved. Gentle curetting later of the bony sinuses to remove necrosed particles, avoiding the periosteum, is allowable. When large, free sequestra are evidenced by the probe, the sinuses should be enlarged sufficiently to permit of the extraction of the loose sequestrum. The curette has been responsible for much damage to otherwise healthy bone and in many patients has simply increased the necrosis.

The treatment of defects in the entire vertical diameter of the lower jaw involves much thought and care and patience both on the part of the surgeon and the patient. At the outset, the surgeon should come to a thorough understanding with the patient, explaining that much patience will be required, since it may be necessary to graft two or three times, in case infection sets in after the grafting, also that it will be necessary to have the jaw fixed either by wiring the upper and lower teeth together or else by some suitable apparatus. Only by absolute coöperation between the surgeon and the patient can a good result be obtained. In a patient with extensive necrosis, where the remaining bone is thin and weak, the patient should be warned not to chew upon hard objects in order to prevent a fracture taking place. If a fracture should occur in conjunction with necrosis, the upper and lower teeth should be held in their proper, original occlusion by wiring the upper to the lower teeth, or by the fitting of some suitable apparatus which will be described later. If there result a space between the fragments when the teeth are held in their proper relations, then one may expect a filling in of a not too large defect by new bone, provided that the periosteum has not been destroyed by the infection or been injured or removed by too vigorous curetting by the general surgeon. In rare instances, the vertical defect may be large, resulting in one of two things: first, if the fragments have not been properly held, they may fall together and unite in such a position that chewing is impossible, due to the posterior displacement of the shortened lower jaw. It will be necessary in such a case to sever the point of union, to separate the fragments, to hold them in their proper relations until the opening into the mouth cavity is closed off, and then, later, to graft a piece of bone, or cartilage, into the defect. Second, the defect with the teeth held in proper alignment may be too large to fill in of itself, resulting in non-union, to remedy which grafting will be necessary. Let us instance a typical case to illustrate the procedures. In most instances the patient will be seen with a sinus discharging under the lower jaw. The teeth have not been held in their proper positions

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and the ends of the fragments have fallen together, where they may or may not have united. There may be inability to chew solid food owing to the posterior displacement of the lower jaw. The first thing to be done is to enlarge the sinuses, then to remove any loose sequestra. If none are loose, a small curette may be introduced and the bone may be gently curetted, avoiding contact with the periosteum. Then the surgeon should patiently wait for the healing of all the sinuses and the expulsion of the sequestra, meantime having the patient frequently irrigate the sinuses. If the patient is seen before the fragments have fallen together, then the upper and lower teeth should be held in their proper positions by wiring them together, or by adjusting some suitable apparatus. In all this work it is most advisable for the general surgeon to associate with himself a dental surgeon who shall have charge of maintaining proper occlusion of the teeth. In my hands, wiring of the teeth has proved a better and easier method of maintaining them in proper position than apparatus. After the sinuses have entirely healed, then the surgeon should consider the best means of filling in the defect. The grafting of either a segment of bone or cartilage into the defect is certainly the only rational line of treatment. This must be carried out with minutest attention to details. The first operation is preceded a few days by the fitting to the upper and lower teeth of Angle's gold or German silver fracture bands with loops on the buccal surfaces. At the operation an incision is made along the lower outer border of the jaw, the point of non-union is exposed, cicatricial tissue is divided, opening into the mouth as little as possible, though this is almost unavoidable. The fragments are forcibly separated by some instrument which can be gradually opened, a most efficient apparatus in my hands being a mouth gag which is provided with two movable mouth jaws which are opened by a screw (pulmotor outfit). After the fragments are sufficiently separated, bronze wires are fastened between the upper and lower loops of the fracture bands, thus permanently maintaining the width of the defect. The mouth will most certainly have been opened in this procedure, rendering grafting at this time futile because of the resultant infection. The wound is sewn up without drainage and allowed to solidly heal for several weeks before attempting any grafting procedure, the defect between the fragments being carefully maintained during this time by rigid, frequent inspection of the wires, which are apt to become loose. At best infection is the "bête noire" of bone grafting operations into the lower jaw. The immediate proximity of the graft to the mouth renders the maintenance of sterility very difficult even with an intact covering of the graft, hence the most excessive precautions should be

taken in making the graft, always using Lane's fracture technic. In the first place the old scar is cautiously opened from below, exposing the lower borders of the two fragments. Working from below upward, the vertical margins of the fragments are bluntly freed for a short distance, avoiding the tissues on the posterior or inner surfaces, and the edges of the bone are freshened with the rongeur. A portion of the outer surfaces of the fragments is laid bare with the periosteal elevator, care being taken not to open into the mouth. Should the mouth be opened into, no grafting should be done at this time, but the wound should first be allowed to solidly heal, when another grafting attempt may be made. Of help in preventing the opening into the mouth is to have an assistant keep a finger in the mouth in the defect to tell when a dangerous approach is being made toward the mouth. It cannot be too strongly emphasized that the smallest opening made into the mouth at the place of grafting is an absolute contra-indication to grafting, for immediate infection of the graft from the mouth produces, without exception, death of the entire graft with its subsequent extrusion. On the other hand, a sluggish infection, not arising from direct contact with the mouth, which develops in the wound some days after the grafting, may have no subsequent deleterious influence on the entire graft, only a part of the graft necrosing away, this having occurred in three of my cases with eventual good results. In one of my cases, a soldier in France, the mouth was opened at the time of grafting, though this was unknown to me at the time of grafting. There was a copious, foul-mouth infection evidenced on the second day by a profuse discharge, which ultimately resulted in the death of the whole graft. My departure from France took place before I could re-graft the defect the second time. During the entire grafting operation the most scrupulous Lane technic must be followed: that is, sterile towels should be clamped to the edges of the wound to exclude contact with the skin. Then no part of any instrument touching the tissues of the wound should come in contact with the operator's hands in any manner. All instruments when once used should be re-boiled before use again. All ligatures and sutures should be passed and tied with instruments without contact with the hands. Only by such means can the conscience of the surgeon be free in case infection subsequently occurs. Infection at best is difficult to avoid even with the most scrupulous technic just outlined, because the covering of the graft with soft parts, separating it from the mouth, is necessarily very thin and these tissues are largely cicatricial in which the blood supply is necessarily very poor and, in consequence, the resistance of the graft to infection is bad. I cannot

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agree with Albee that a bone graft is at all resistant to infection. It is badly vitalized tissue, poorly supplied with blood, and in my experience much more liable to infection than normal tissues. It would be very advantageous if we could graft into a jaw defect some tissue more resistant to infection than bone. With this in view the suggestion of Morestin¹ seems most valuable. He uses costal cartilage instead of bone in making grafts into the lower jaw, maintaining that the resistance of cartilage to infection far surpasses that of bone, that cartilage does not become absorbed and that it can be very easily cut with the knife to any desired shape. The seventh or eighth costal cartilage can very easily be removed entirely or a segment may be cut out of one of them. It is beautifully tolerated by the tissues. It may be inserted end-to-end and held there by sutures or be inlaid just like a bone graft. In my next lower jaw grafting I purpose using cartilage instead of bone for reasons already given. To return to the bone grafting interrupted above, the vertical edges of the fragments having been freshened and the outer surfaces laid bare, transverse grooves are cut in the outer surfaces of the two fragments for at least an inch long with either a chisel or the twin motor saws. Two holes on each fragment are drilled from the sides, running into the grooves. Kangaroo tendon sutures are then threaded through these holes. A corresponding sized graft with the covering periosteum, the latter taken larger than the bone transplant itself, is cut out of the tibia with the marrow also. No hand touches this graft at any time. The graft is placed in the grooves prepared in the lower jaw under the kangaroo sutures which are then tied with instruments over the transplant, securely holding the graft in place. I formerly used metal sutures but have now substituted for them kangaroo tendon or chromic gut, since these have less tendency to invite suppuration than non-absorbable sutures. The wound is then closed by suturing the deep tissues securely over the graft and in contact with it and over this the skin is sutured separately. Before the anæsthesia is completed, care should be taken to see that the wiring of the teeth is securely and accurately maintained. A dressing is applied to the wound and between the dressing and the mouth a sheet of rubber tissue is glued with ether to the skin to exclude the possibility of dribbling from the mouth reaching the wound. The after-treatment consists in careful, frequent watching of the wires between the teeth to see that they do not become loose or broken. There must be no mobility whatsoever between the fragments for three months, for movement is fatal to grafts. In my experience the wires will have to be readjusted, tightened or replaced on an average of every two weeks. The patient is fed soft diet through any existing

cavities in the teeth, or liquid diet may be administered. Feeding has not furnished any difficulties in any of my cases and none of the patients have complained of this. For various types of splints to hold the jaws see Morestin¹ and Mitchell.²

A second method of grafting is to place the ends of the grafts in contact with the freshened ends of the fragments, with or without kangaroo tendon sutures being passed through holes drilled in the extremities. This method does not hold out so good a prospect for life of the graft owing to the contact of bone to bone being much less. In addition the danger of opening the mouth is greater, since a larger posterior surface of the fragments has to be freed and laid bare. Such grafts have, however, the advantage of wedging the fragments apart.

The main lessons to be learned from these patients are as follows:

1. Infection from the mouth at the time of making the grafts is absolutely fatal to the entire graft.
2. Infection appearing weeks after the grafting, not dependent on immediate connection with the mouth, is by no means fatal to the entire graft. A part only of the graft may necrose away.
3. No grafting should be made in the presence of a sinus or into a granulating cavity.
4. Grafting should be performed any number of times until a successful result is obtained.
5. In view of the great liability of bone grafts into the lower jaw to infection, the author is inclined in his next cases to use costal cartilage as grafting material, since this is more viable than bony grafts and is not so liable to become infected.
6. Absolute immobility of the lower jaw is a *sine qua non* to a successful result. Wiring the teeth has proved, in the author's experience, more successful than splints. It should be maintained for three or four months after the grafting.
7. The inlaying of the graft (always with its periosteum) into grooves cut in the sides of the fragments would seem to be a more scientific procedure than an end-to-end grafting.
8. Metal sutures had best not be used, owing to their liability to invite infection.

CASE I.—Previously reported.² Result fine. The patient died a year after the grafting of pneumonia. Dr. Downes saw the patient before her death and will testify to the good result.

CASE II.—The first grafting in this patient was reported² previously. The report of the second grafting has not been published and is as follows:

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J. O., Italian woman, forty years of age. Prior to the first grafting, consolidation had taken place in such a bad position that chewing of solids was impossible. The site of consolidation was chiselled through, the fragments separated and later a bone graft was inserted which was held with metal sutures. There occurred infection of the graft which necessitated its entire removal. The wound had entirely healed, the teeth being held as well as possible with wires in their proper relations, thus maintaining the defect. This was difficult, as the patient lived in the country, could speak no English, and always returned with the wires loose or broken.

Second bone grafting operation, May 18, 1915 (Fig. 1). Intranasal ether anaesthesia. Incisions along old scar in lower cheek; curved incision with convexity inward along right tibia. Pathology: The defect was dissected out, measured 2 or $2\frac{1}{2}$ inches long transversely. The posterior fragment ended in a thin plate of bone anteriorly. The total vertical diameter of the bone had necrosed away. The lower teeth which remain have been wired to upper, maintaining the defect. Procedure: Old scar circumscribed and skin surface of cicatrix removed. End of anterior fragment exposed and cleared of tissue. Edge freshened with chisel. Posterior fragment exposed deep in tissues under masseter muscle. Was a thin bony sheet. Tissue reflected from both its surfaces for an inch. Hole drilled $\frac{1}{2}$ inch from its edge. Drill hole in anterior fragment. The tissues between the fragments were carefully separated, an assistant's finger being in the mouth to prevent entering into it. Lane's technic throughout. Right tibia exposed. Length of bone required measured off and the periosteum cut $\frac{1}{2}$ inch longer all about and divided. Motor saw cut the graft exactly as laid out and went into medullary canal, erroneously including the crest. Width of graft about $\frac{3}{4}$ inch, thickness about $\frac{1}{4}$ inch, and length about 2 inches. Each fragment end drilled. Chromic gut used. Periosteal surface of graft was placed in the defect toward mucous membrane of mouth posteriorly, the posterior side of graft was placed on outer side of the posterior fragment and held there by chromic suture (Fig. 1). Anteriorly a step was made in side of anterior fragment and into this the blunt, anterior end of graft was fitted and held there by chromic suture through drill hole in anterior fragment and through drill hole cut in the anterior end of the graft. Graft fitted finally beautifully in place. A small piece of the graft which had been cut off, measuring about $\frac{1}{2}$ inch square with periosteum on it, was placed next to graft posteriorly as an additional osteogenetic stimulus and was covered over by the

surrounding tissues. Whole graft buried by plain catgut suture, bringing tissues over in front of it. Interrupted silk sutures in skin.

Went home on June 4, where she broke her grafted leg by tripping. Treated at home by family doctor with splints for 40 days.

July 31 came to office. Jaw looks finely. Limps slightly. Jaw healed solidly. Wires between teeth all broken. Replaced.

September 30: All wires removed. Great difficulty in wearing them because she invariably broke them. Graft feels finely.

Fig. 2 shows the graft seventeen months after it was implanted. Chews well. Motions of jaw perfect. Graft intact and solidly united.

CASE III.—Previously reported.² This patient shows the value of periosteum on a graft. In 55 per cent. of my experiments on bone grafting if the transplant was without the periosteum the graft disappeared. In this case it was entirely gone in five months. In November, 1910, I removed half the lower jaw from a lad of 12 for a large giant-cell sarcoma. Fifteen months later I grafted into the defect in the lower jaw a piece of rib which was entirely stripped of its periosteum. One end of the rib was bevelled and this was sutured to the freshened edge of the remaining half of the jaw. The wound healed by primary union. Five months later a röntgenogram showed entire disappearance of grafted rib. There never was any discharge from scar.

CASE IV.—This patient³ was a soldier in France suffering from a shell wound of cheek, upper lip and nose, and with the loss of an inch and a half of the entire vertical diameter of the lower jaw (Fig. 3). The left half of the lower jaw was maintained by wiring it in its proper relations to the upper teeth during the entire healing process. Several plastic operations were necessary upon the soft parts. The final result of these is shown in Fig. 4. I grafted a piece of bone from his tibia with periosteum, end to end, in the defect, suturing it with chromic gut. Unfortunately I did not appreciate at that time that I had minutely perforated the mucous membrane of the mouth. A foul discharge immediately set in, resulting in the death of the entire graft which had to be removed *in toto*. I left France before I could re-graft this patient. I learned that he was subsequently sent to the Hôtel Dieu to be under the care of Professor Morestin.

CASE V.—Unpublished. J. C., aged nineteen. Admitted May 9, 1916. History 31,463.

Five and one-half months ago shotgun, accidentally discharged, caused large laceration of left side of chin and compound fracture of mandible. Three and a half months later (early part of March), while a sinus discharging pus was present, a Lane plate was inserted in another hospital, between the fragments. This



FIG. 1.—Case II. Shows end-to-end graft from tibia with periosteum held by kangaroo tendon sutures through drill holes.



FIG. 2.—Case II. Shows graft seventeen months after it was implanted. It was firmly consolidated with the ends of each fragment.



FIG. 3.—Case IV. Shell wound of face of French soldier, involving lower cheek, lower jaw, upper lip and nose. The loss of bone in lower jaw was one and a half inches longitudinally and involved the entire vertical diameter.



FIG. 4.—Case IV. Final result of plastic operations on face.



FIG. 5.—Case V. Shows improper closure of defect by a Lane plate, as this caused malocclusion of the teeth. Also shows buckshot peppering the tissues. These were not removed.

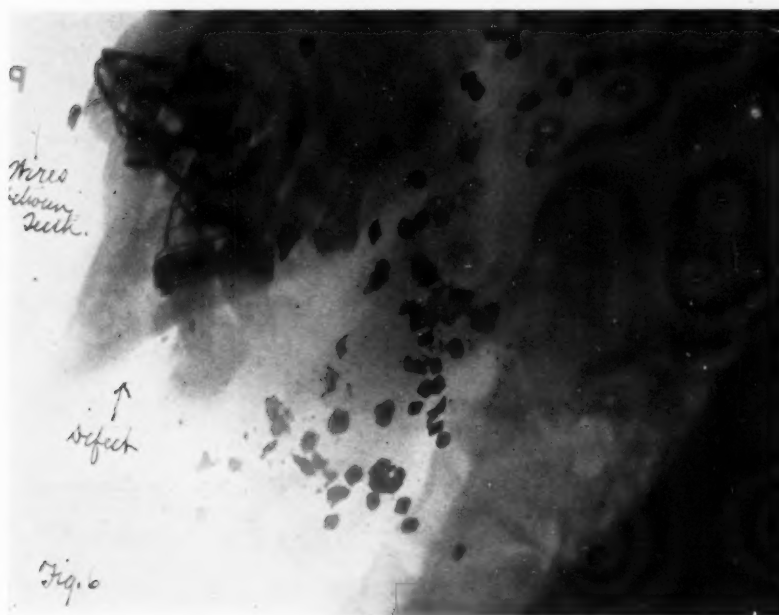


FIG. 6.—Case V. Result after removing the Lane plate, separating the fragments sufficiently to make proper occlusion between the teeth and wiring the upper and lower teeth in their proper positions. This brought out the defect.



FIG. 7.—Case V. Shows the graft from the tibia inserted into grooves cut in the outer surfaces of the fragments.

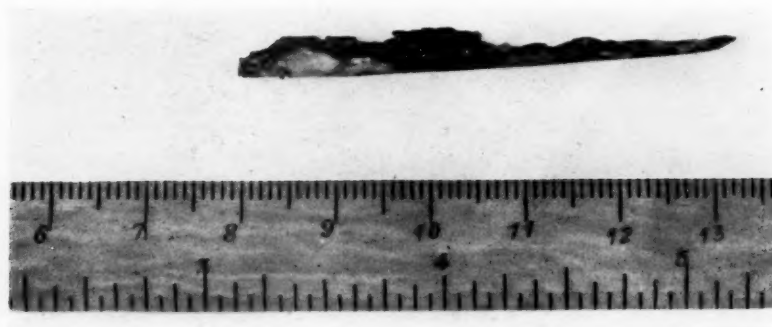


FIG. 8.—Case V. Sequestrum of graft which was removed three months after operation.



FIG. 9.—Case V. Shows plaster helmet and chest extension made to hold hand against cheek while pedicled flap from forearm was healing into cheek.

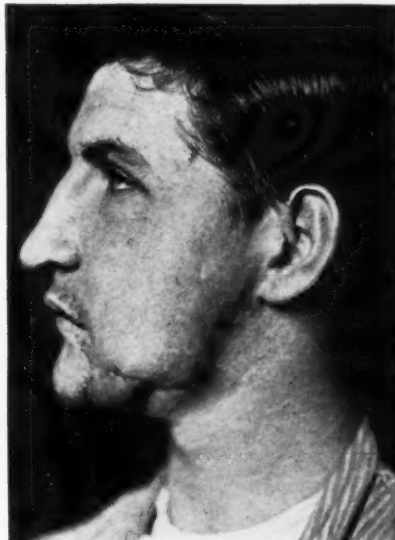


FIG. 10.—Case V. Shows result of grafting skin and fat, pedicled to the forearm, into the depression of the cheek.



FIG. 11.—Case V. Röntgenogram of defect in lower jaw. It has solidly filled in with bone from the graft despite the sequestration of part of it. Taken three months after the grafting.



FIG. 12.—Case VI. Shows defect made by bringing lower teeth in proper alignment with upper, where they were wired.

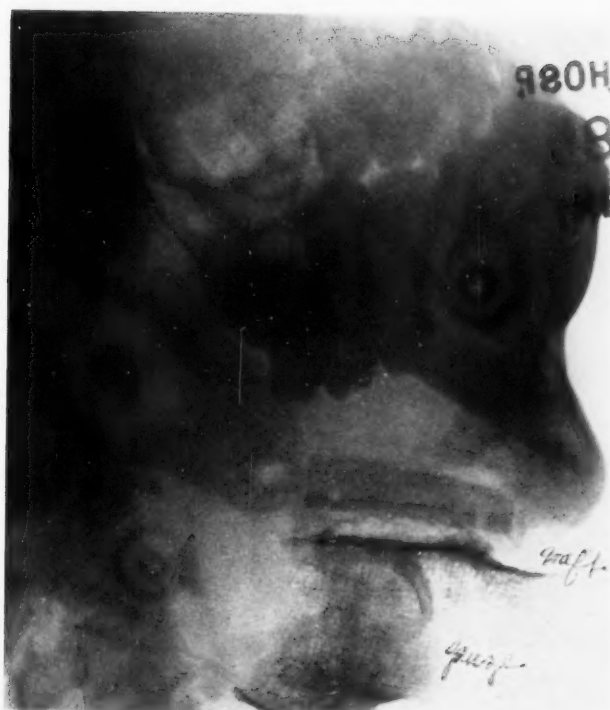
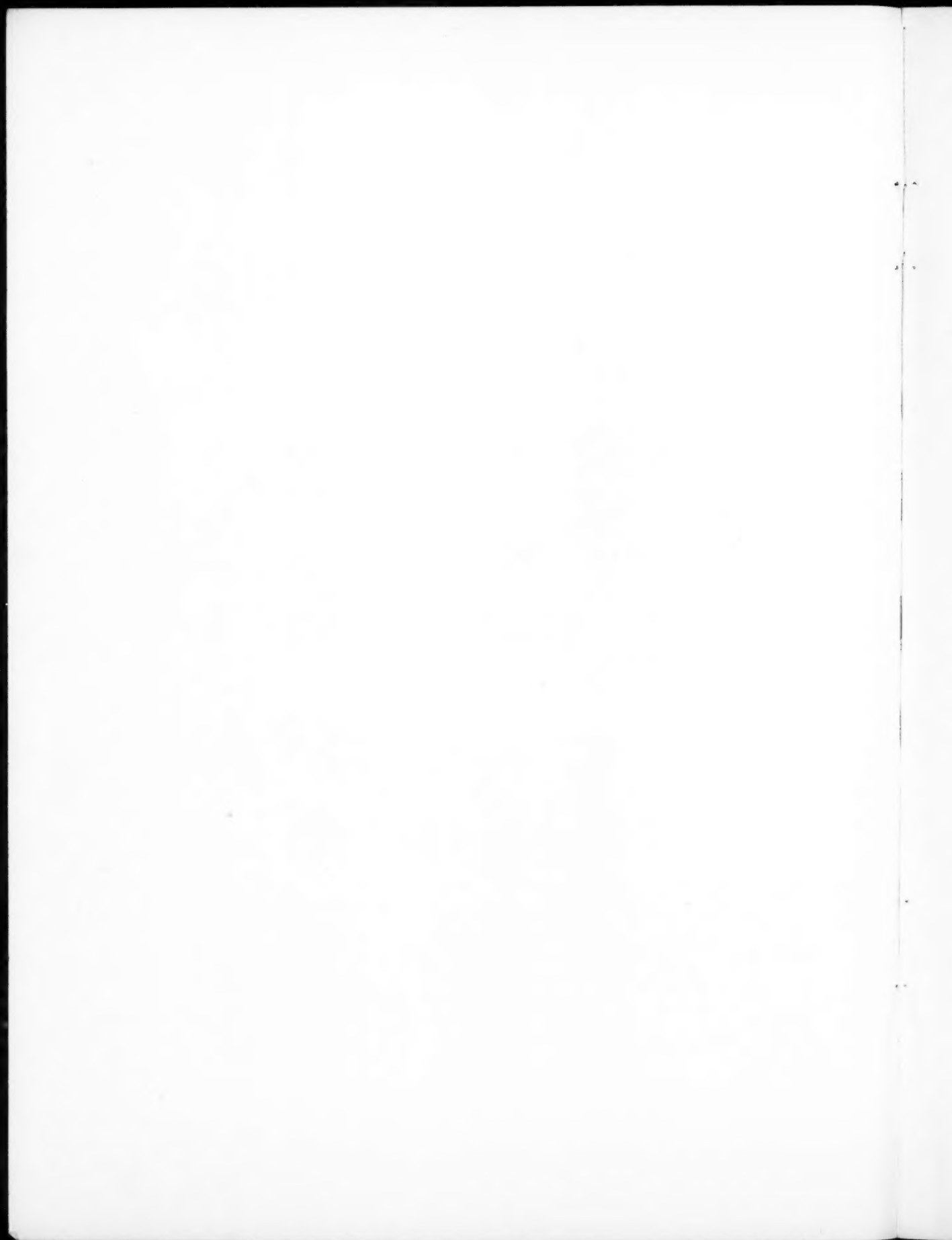


FIG. 13.—Case VI. Shows end-to-end graft from clavicle in position, pedicled by soft parts, held by kangaroo sutures.



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loosened in two and a half weeks. A sinus persisted till two weeks ago, when it closed (Fig. 5).

Examination.—On the left side of the lower jaw is a large, stellate scar with a depressed centre attached to the bone beneath. The mouth can be opened only one-third its normal extent. On closing the teeth the lower incisors are posteriorly placed one inch behind the upper, rendering effective chewing impossible. There is evidently a loss of substance of about an inch in the vertical diameter of the left side of the lower jaw with considerable mobility of the fragments. There is no sinus. Röntgenogram showed the neck studded with buckshot and there was a loose Lane plate between the ends of the fragments (Fig. 5).

First Operation (May 11, 1916).—Intranasal ether anaesthesia, through tubes in the nose. Incision: Transverse along left lower jaw beneath the defect.

Pathology.—Non-union of the fragments which had approximated each other on the left side. The defect, when the fragments were separated into their proper positions, measured about one inch transversely. With the fragments unreduced there was no approximation of the lower teeth to the upper, the right larger fragment being drawn over to the left so that the lower teeth were one inch posterior to the line of the upper teeth. There was no dead bone evident anywhere.

Procedure.—Fragments exposed and search made for the Lane plate with two screws as seen in the X-ray plate. This withdrawn after exposing it. Fragments were separated to their proper relations and were wired in these positions to the upper teeth by Dr. V. E. Mitchell (Fig. 6). In making the separation the mouth was opened. Rubber tissue drain externally in middle of wound. Continuous silk skin suture. No attempt was made to extract the numerous buckshot. None were seen in the wound during the operation. A future lead-poisoning from these retained lead bullets is a possibility but scarcely a probability. Very few cases of such subsequently occurring are on record.

Comment.—The previous application of a Lane plate in this way was a wrong procedure, for, by bringing the ends of the fragments together, malocclusion would have resulted had they healed in this shortened position. Instead the teeth should have been wired together in their proper relations.

After-result.—The wound healed almost by primary union.

Second Operation (June 7, 1916).—Bone graft from tibia into defect in lower jaw (Fig. 7). Intranasal ether. Incision along under side and parallel to lower border left jaw. In right leg middle, curved incision with convexity anterior.

Pathology.—Defect in lower left jaw one inch in breadth just

posterior to middle line. Filled up with scar tissue. Defect had been fully maintained by wiring the separated fragments in their proper relations to upper jaw. Since first operation, clean wound.

Procedure.—Lower borders of the defect developed by separating the soft parts from them and this continued along the outer surfaces for an inch away from their free borders. In making a furrow across the defect carefully through the scar tissue a suspicious bubble occurred once as though the mouth was opened into by a minute perforation but there was no certainty. Along the outer surface of the posterior fragment a furrow was cut with the chisel and its edges were drilled in two places running into the furrow. Kangaroo tendons were threaded through the holes. In the anterior fragment a furrow was cut with the twin motor saws and holes were drilled in its lower border and kangaroo tendons threaded through them. From the right tibia was cut a segment with its periosteum intact, about three inches long, with the twin saws. The crest was not included in the section. There was marrow on the fragment. The graft was inserted in the furrows in front and behind and the kangaroo sutures were tied. There were two sutures on the anterior fragment and one on the posterior. The fit was very good. The skin edges were loosened up. Deep plain catgut sutures partially brought the deep tissues over the graft and the skin was sutured together with plain silk interrupted sutures. A starch bandage was placed under and around the chin and over the head. Rigid Lane technic was maintained throughout. The graft was not touched by the fingers at any time. No drainage.

After-result.—The skin over the graft was evidently too thin and cicatricial to remain viable with the amount of tension present. Two weeks after the operation there was some necrosis of its skin edges, exposing the graft beneath. This never closed. For three months the teeth were maintained immovable by wires. By this time a sequestrum (Fig. 8) had separated from the graft, and on September 12, 1916, it was lifted out by enlarging the sinus in each direction under novocaine anæsthesia. The wound healed solidly immediately thereafter. There was solid union between the fragments and all the wires were removed three and a half months after the grafting. There was considerable stiffness of motion in the lower jaw at first, but by the patient forcing the lower jaw down with his fingers continually a very good opening of the jaw was obtained. Chewing has been perfect since that date. A plate provided with four false teeth was made to fill the defect inside the mouth. The result has been perfect.

The patient was not satisfied with the depressed scar on his face so I agreed to try to remedy this. I have never had success

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with the Krause or Wolff free grafts, consisting of the entire thickness of the skin, although Krause reports a number of such graftings into the face with success. Presumably the rich facial blood supply has had much to do with this. I determined to transfer a flap of the whole thickness of the skin with the fat pedicled to the forearm, into the freshened defect.

Fourth Operation (September 27, 1916).—Intranasal ether. Plaster helmet (Fig. 9) was made the day before operation, going around shoulders and with a prolongation to support right arm. Scar in cheek dissected all out and loosened up from the underlying tissues, resulting in a triangular raw area, whose base below was two inches, with apex above. Right forearm prepared and a flap three times as large as necessary to fill the defect dissected from middle of forearm with base towards wrist and about three inches long, the fat being included in the flap. This was turned so the raw surface came against the raw surface of the defect and its tip sutured with finest silkworm gut to the skin edge of the face posteriorly and also as far below as possible. Hand then bound to head helmet with plaster bandages and plaster also applied about chest and right arm.

After-result.—The patient suffered so much from the confined, high position of the forearm that on the ninth day after the formation of the flap, it was determined to sever the flap.

Fifth Operation.—After being made unconscious, flap was divided close to forearm. Plaster helmet was then divided and removed. The edges of the flap were trimmed and some of the under surface of the flap. The flap was adherent for one inch posteriorly to the skin of the face. Anteriorly, the depressed portion of the scar was excised and the edges lifted up. All about the defect the edges were freshened. The defect was triangular with base below of about two inches length. The flap was trimmed so that it filled the defect without tension. It was sutured to the face by finest silkworm gut sutures. Under its lower edge a slip of rubber tissue drain was placed. The result was good. Over the graft rubber mesh was placed and gauze wet in salt solution. The raw area in arm was covered in spots by the entire thickness of the remnants of the face flap, cut in small pieces, from which all the fat was removed, Wolff grafts. These were covered with rubber mesh.

After-result.—The graft into the face took almost by primary union, except at its most anterior edge, where there was a slight necrosis. Much to my surprise the Krause grafts into the forearm all took beautifully. It was later thought best to apply some "pinch" skin grafts to close the remainder of the forearm wound. The patient is to be congratulated on his patience in enduring all these procedures, but the good result has well repaid him. The

defect has become filled in with new bone (Fig. 11) and the alignment between the upper and lower teeth as well as the movements of the jaw are sufficiently satisfactory to perform mastication perfectly. In addition the scar has been made much less disfiguring (Fig. 10). I should like to ask the members of the Society what success they have had with the Krause-Wolff free skin grafts and whether I would have been justified in making such a graft in this patient's face?

CASE VI.—H. C., colored, aged thirty-three, admitted August 26, 1915. Sent to me by Dr. H. S. Dunning from the Dental College. On March 16, 1914, patient was struck with a "black jack" which produced a compound fracture of the lower jaw. The fracture was a little to the right of the symphysis. Inflammation and swelling set in and he went to a hospital, where a piece of bone was taken from the jaw and four teeth were extracted. In six weeks the sinus had healed, but he could not chew his food. For ten months, at intervals of two weeks or more, there was much pain in the jaw, it was hot and tender, relief being felt when pus was discharged. At present the patient can open his mouth only half its normal extent and cannot chew. Examination shows an irregular scar with two sinuses, each exuding a drop of pus, in the middle of the right ramus of the mandible. Right ramus is angulated inward; left ramus has fallen in to fill up defect in bone, producing no occlusion whatsoever to teeth. There are motion and crepitus at the fracture spot.

First Operation (August 27, 1915).—Intranasal ether. Incision along right lower jaw.

Pathology.—The left half of the jaw had drawn over to the right to fill up the defect of an inch transversely, consisting of the entire vertical diameter. No attempt was to be made to graft bone from the tibia into the defect until all the sinuses should have closed. Infection came from the roots of two teeth which had to be extracted. These roots opened directly into the operative wound. No dead bone seen.

Procedure.—Incision carried down to the edges of the defect. A projecting lower, pointed end of a tooth was seen above. This tooth drawn and one anterior to it. This opened the mouth and later the mucous membrane had to be opened for at least an inch. The defect was then increased by drawing the left half of the jaw over until it came in its proper relation with the upper, where it was wired to the teeth. The defect between the bones was then at least an inch wide and one looked directly through the defect from the outside into the mouth. No dead bone visible anywhere. Mucous membrane sewn over the defect with catgut. Rubber tissue drain followed by continuous black silk suture in skin.

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After-result.—For three weeks food and saliva came through the wound, then the wound healed solidly.

Second Operation (September 15, 1915).—Intranasal ether. Incision over left side of lower jaw through old scar.

Pathology.—Teeth had been wired in their proper relations and held so. The defect (Fig. 12) was about $1\frac{1}{2}$ inches to be filled. This area was filled with scar tissue. After opening into the mouth by accident it was deemed inadvisable to graft because of infection. As it was impossible to open the scar again without opening the mouth if it were allowed to heal, the wound was packed.

Procedure.—Scar opened cautiously. Ends of fragments exposed and freed. The anterior fragment was rough, so it was smoothed off with the rongeur. The posterior fragment was a thin plate, necrosis had removed all the horizontal plate posteriorly. On attempting to make a furrow in the soft parts, the mouth was opened. The opening was about the size of a dime. This was sewn up with plain gut. It was thought best to try to let the cavity granulate and then to graft into this later. Wound strewn with aristol and packed. Starch bandage about the head.

After-result.—Very little discharge from the wound and practically no mouth discharge. October 5, 1915, granulating cavity was half closed in, and mouth was entirely shut off. Had been dressed with aristol. Wires had been removed, because they became loose very easily, and an interdental splint made by Dr. Mitchell was substituted, which was worn at time of operation.

Third Operation (October 5, 1915) (Fig. 13).—Intranasal ether. At each of the two preceding operations to make a furrow to lodge the graft, the mouth was opened. So at the end of the second operation I decided to close the mucous membrane of the mouth off with sutures and to let the remainder of the wound granulate and into this granulating cavity to insert later the graft. Since a pedicled graft is more liable to live in the presence of infection than a free graft, it was decided to pedicle with the overlying skin a graft from the clavicle into the defect. A free graft in the presence of infection *might* live, but it would be very uncertain, since infection was known to be present.

The original incision in the jaw was prolonged anteriorly over the ends of the bones. The whole incision was scraped out so as to remove the granulating tissue from the soft parts, and tincture of iodine was applied. The anterior end of the bone was laid bare and was very thick through. Rongeur freshened the edge. Hole bored through the end transversely. The posterior edge was freed and freshened with the rongeur and drilled through, its anterior surface being pried free of tissue. Exact length of defect measured with piece of rubber tissue. This laid on clavicle and marked out as being the length of bone desired. Skin

incision made half an inch wider on each side and carried down in a circle one inch below clavicle on chest. It was surprising how much the skin contracted when divided. Flap dissected half-way to lower jaw, going beneath deep fascia and platysma. Transverse division of periosteum on clavicle, the length of the graft being about one inch and a half. Longitudinal anterior division of clavicle for requisite length into medullary cavity and posterior transverse division by motor saw. This motor saw was supplemented by metacarpal saw. Small chisels then inserted broke off the graft from posterior part of clavicle with division of posterior periosteum somewhat larger than the bone graft. Incisions then made up vertically along the neck, carrying the original lateral incisions up, dividing the platysma and reflecting this up with the flap. It was necessary to make the flap up to the middle of the neck before it could be reflected into the defect, where it was twisted upon itself to bring the skin surface external. Drill holes made on each end of the graft. Kangaroo tendons threaded anteriorly and posteriorly and tied. Graft in good position between ends of bones (Fig. 13). Upper margin of skin edge sutured to upper edge of defect with interrupted black silk. Two plain catgut sutures between lower edge of defect and skin over graft. Remainder of wound closed with black silk. Considerable undermining had to be done before tissues came together over neck and shoulder. At first fascia brought over defect in clavicle by three catgut sutures, then side-to-side union of upper part of skin defect and the final closure was made by an inverted "T," the cross-bar being on the shoulder. Interrupted silkworm gut sutures used. Rigorous Lane technic throughout.

After-result.—At the end of a week there was gangrene of the pedicle which had to be cut away in consequence. For a time it looked as though the graft might live but this proved illusory. The infection was too much for the graft to retain its life. It finally entirely sloughed and had to be removed. During an absence in France, I lost track of this patient and now I cannot find him. I should try to persuade him to let me graft his jaw again could I see him. As a result of this procedure I doubt if I should again attempt to transplant a bone graft into a granulating cavity, although several such successful graftings have been reported.

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- ³ McWilliams: Jour. Amer. Med. Assoc., vol. lxvi, April 8, 1916, p. 1085.

STUDIES IN PLASTIC SURGERY OF THE FACE

I. USE OF SKIN FROM THE NECK TO REPLACE FACE DEFECTS. II. PLASTIC OPERATIONS ABOUT THE MOUTH. III. THE EPIDERMIC INLAY

By J. F. ESSER, M.D.

OF HOLLAND

SPECIAL SURGEON FOR PLASTIC OPERATIONS AT THE K.U.K. RESERVEHOSPITAL NR. 8, VIENNA

I. USE OF SKIN FROM THE NECK TO REPLACE FACE DEFECTS

IN this war I went to Austria to help to repair and undo a little part of the cruel mangling that millions of men have produced over all Europe. First, during eight months, I was chief surgeon of a very large barrack-hospital with 3600 beds, in Moravia, and afterwards I worked till now in my special branch of plastic work in different hospitals of Vienna and in the University surgical clinic of Hofrath Prof. von Hochenegg. As I made in Austria over 700 plastic operations on war-cripples I enlarged my practical experience, especially in repairing defects of the face in an important manner. In the present paper I desire to present a new operative system, which I introduced for repairing upper lips, cheeks, eyelids and noses.

The methods in general use did not satisfy me, as the results were not sufficient in an æsthetic and functional way. The use of the pedicle flap of skin from the arm or wandering flap from the breast is generally, besides its disagreeable technic for the patients, decidedly disfiguring. The color, paleness, hairlessness, flaccidness and other particulars or qualities differ so much from the skin of the face, especially in the neighborhood of the nose, that such a technical successful plastic only succeeds in closing the defect, but does not construct a proper lip.

Perhaps a temple pedicle flap is better, partly hairless for mucous membrane, partly with hair for the skin of the lip (Lexer). I saw a case in Prof. v. Hochenegg's clinic, where Dr. Demmer had used for replacing an under lip and mucous membrane a very large temple pedicle flap; partly with and partly without hair, with a pedicle scarcely finger broad; the temporal artery, with its branches, had been found and marked out with lapis before the operation. The result was very satisfactory. In general I do not like this method, as the temple defect is most difficult to heal æsthetically.

My cuts for upper-lip-cheek defects vary according to the size and place of the defect. They all have the same principle, that the arteria maxillaris externa lies in the centre and the cut first rises, then makes a broken curve, passing under the ear and taking more or less of the

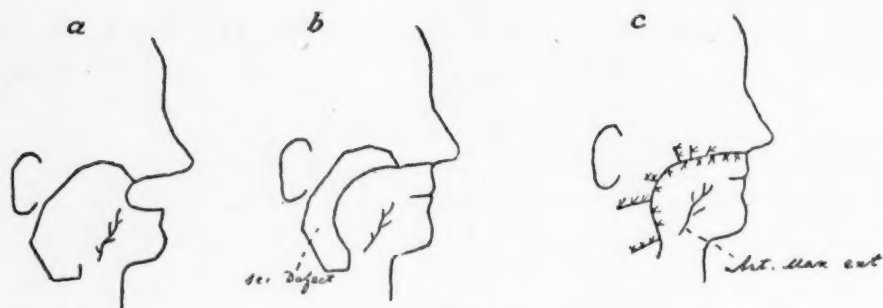


FIG. 1.—Upper lip defect.

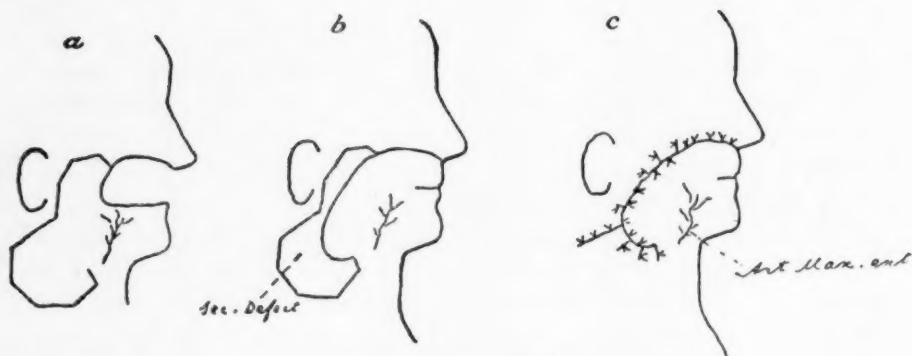


FIG. 2.—Lip-cheek defect.

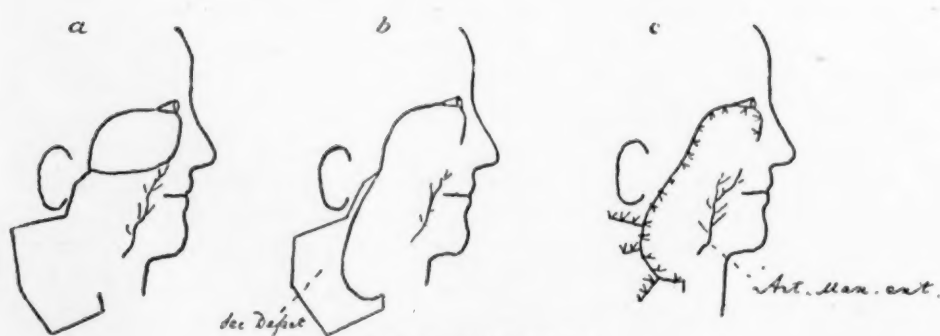


FIG. 3.—Eyelid-cheek defect.

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neck, according to size of defect (Figs. 1-3). The end of cut is always suddenly vertical, so as to make the whole movable. In some cases both cheeks are used, but mostly one side suffices, even for very large defects. After making the piece as movable as required, it is then turned and placed in the defect. The cut varies according to the presence or absence of hair, and if the defect also extends to the eyelid. Further, a somewhat similar cut is necessary in the mucous membrane of the mouth, again commencing at the same place and in the same direction, but turning before reaching the ductus stenonianus. At the end of this cut is also a sudden perpendicular incision to facilitate its removal. The mucous membrane cut is not only important for the removal of the whole part, but also because the sewing together of the mucous membrane wound after the removal supplies a surplus to be used for the inside of the new lip. The first part of the cut may split the entire cheek, but further on it must gradually be less deep for fear of injuring the facial nerve or the ductus stenonianus. That the nourishment of this turned cheek piece, one can scarcely call it a pedicle flap, is very good, is shown in the sketches attached and in the good results of the operations. The healing is without exception beautiful, as nowhere is any great difference in color or quality of the joined skin parts. The tension is, as far as the neck, quite regular. At the neck itself it is the greatest, so that we can say, practically, the defect is replaced by skin from the neck. The secondary defect, after the primary defect is closed, is mostly shown by a great gap in the neck. The wound edge at the back is then diminished by sewing the edge together at the cut intervals (*vide* diagrams). These stitches can bear very much tension. In this way the back edge approaches the front one, till they can be easily sewn together. I never leave any part unclosed. This I do in all my facial plastics. It is only possible because a beautiful plastic is always a mathematically correct and maximally economical one, and there remains no unused folded skin in the turned pedicle.

The apparent danger of injuring the ductus stenonianus and nervus facialis is, by careful technic, very small. Only once I met with a temporal facial paresis, which did not appear directly after the operation, nor the next day (as I never give dressing, I at once see any disturbance), but only some time later. It has arisen in consequence of the inflammation of a few stitches near the ear-lobe, where the healing did not immediately set in, but followed later on with good result.

Sometimes small salivary fistulas appear which heal in a few days without lapis treatment. I don't like the use of this, as it leaves scars. In such cases, after thoroughly cleaning with ether, I put two drops of

collodion on the fistula and as soon as the liquid is nearly dry, I press a little cotton wool with the finger for some moments on the fistula. If pus has collected under the wool, the next day, I take off the collodion skin and wait till the wound has cleaned itself. This collodion treatment is repeated till healing ordinarily appears. I never saw a fistula remain which had to be operated, which can only be explained by the fact that I never cut through the ductus stenonianus, but only injure the gland tissue of the frontal terminals of the parotis or parotis accessorius.

I will give some specimen cases of my material in this method, showing how different kinds of defects may be treated.

CASE I.—Soldier S. (Figs. 4-7), K. u. K. Reservespital Nr. 8 at Vienna. The patient had lost an eye, the greater part of the cheek and of the under eyelid by granat-shot. He had been operated elsewhere, but the plastic had not succeeded. There was placed a pedicle flap partly hairless, partly without hair from the temple, and turned till the axis stood horizontally, and was then sewn into the eyelid-cheek defect. The flap had not sufficed as Fig. 4 shows and finally had shrunk through necrose, besides it had wrinkled and was very hairy. The temple (secondary defect) was very deformed as the substitute was quite hairless and consisted only of scar, wound and Thiersch islands. Therefore I tried to undo this work as far as possible. After cutting out the original temple wound, I unfolded the flap of the cheek, which was very difficult to do, as the folds were deeply seamed. Finally, the replacement of the flap succeeded very well, as shown in Figs. 5 and 6. After that the new cheek-eyelid defect was repaired with cheek-neck skin flap as described and shown in the diagrams. The healing retarded only in some stitches near the ear-lobe where a temporary paresis of the mouth facialis branches arose which soon disappeared. After this first operation skin material was present everywhere, as Fig. 5 shows. Afterward some corrections had to be made. Fig. 6 shows the result after the second one, which enlarged the length of the cheek at the cost of the width by taking a pedicle flap including the vertical scar of the nasolabial fold, turning it upward till it was horizontal, then placing it under the eyelid in horizontal incision so as to elevate the lid. Fig. 7 shows the situation after another correction of the eyelid and levelling the cheek.

CASE II.—Soldier B.T. (Figs. 8-11), K.u.K. Reservespital Nr. 17 at Vienna. Complete upper lip defect after a gunshot—broad, deep scar in the right cheek, besides defect of processus alveolaris on the right and in the middle. The mucous fornix was missing there. After the first operation in my method here given the



FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.

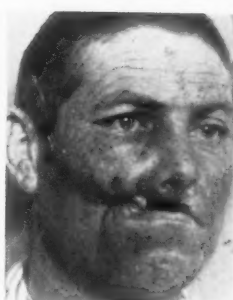


FIG. 8.



FIG. 9.



FIG. 10.



FIG. 11.



FIG. 12.



FIG. 13.



FIG. 14.



FIG. 15.



FIG. 16.



FIG. 17.

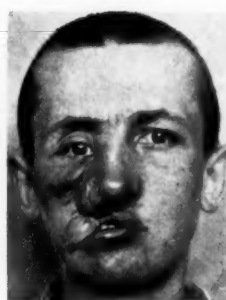


FIG. 18.



FIG. 19.



FIG. 20.



FIG. 21.

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practical and æsthetical results were already good, though on the right cheek was a large scar. The jaw and the face muscles were all freely movable, only the mucous fornix was failing to receive the dentical prosthesis. On the left side, where the same method had been used, the healing was beautiful. Some small corrections still have to follow. Figs. 10 and 11 show the patient after the first operation *before any correction*. As the correcting operations are not yet ready, I mention only the first result.

CASE III.—Soldier H. (Figs. 12–15), K.u.K. Reservespital Nr. 17 at Vienna. Shot injury of the right upper lip; nostril quite drawn aside, and mucous fornix defect. By cutting the cheek only to the neck, I could obtain a sufficient flap to cover the defect caused by the excision of the scars. The nostril was at the same time released and set right. Some small corrections were made afterward. The upper lip shows still a little œdema, which disappeared afterward by massage. Fig. 13 shows the result of the first operation, Fig. 14 after the correction of the cheek scars, Fig. 15 after lip correction.

CASE IV.—Soldier L. (Figs. 16–21), K. u. K. Reservespital Nr. 8 at Vienna. Total defect of the upper lip. Processus alveolaris nearly fully absent, perforation of the bony palate, cheek scarred, upper jaw grown together in a downward position after fracture. The right eye, quite blind, had slipped down, following its support. The nose was quite crooked and turned inward.

Here I came out with my method by making a large cut only on the right side, put besides, however, the skin part from between the two cheek scars as a pedicle flap (pedicle near the nose), first into the lip defect and joining the large patch to it, which also filled up the secondary defect made by the first flap. The new defect caused by the displacement of the large flap was closed in the ordinary way.

This particularly complicated proceeding made more after-corrections necessary, but was requisite on account of the situation of the two large, very deeply branched scars. Figs. 18 and 19 show the result after the first operation, Fig. 20 after a plastic of orbicularis oris muscle with mucous membrane (a pedicle flap from the under lip), Fig. 21 some weeks later on. There must still be made many small corrections before the case is finished; and because it is very important that between two corrections a very long time elapses till the vessel communications in the connecting lines are good, it will take several months before all is finished.

As this publication only intends to show the principles of my method of repairing facial defects from the neck, it was not necessary to wait till all the corrections of the cases were ready.

II. PLASTIC OPERATIONS ABOUT THE MOUTH

In defects and deformations of the under lip many and various methods by plastic operation have been applied. Mouth operations have occupied surgeons since the ages of antiquity, and belong to the most difficult plastics that exist when a fine result is desired; however, they are very easy when patient and surgeon are soon satisfied. The elastic surroundings, with loose fixture on the bones at a distance and with excellent vascularization, make it possible to close the defects after various methods with good healing results. Later the continual work of the free and muscular surroundings helps to improve the results.

Nevertheless, after all, a mouth result almost always in respect to movement, shape or size, leaves much to be desired. The absence of bony fixture of the mouth tissue, however it may facilitate the joining of the defects, demands an independent regular construction of the new mouth, as one finds nowhere any firm support.

The great number of procedures which are all used satisfactorily, declare that every one affords good help but no one gives entire satisfaction. We find drawings and descriptions of these methods *in extenso* by Bockenheimer (Plastische Operationen), Lexer (Handbuch der chirurgischen Technik, edited by Bier, Braun and Kümmel, or in the Handbuch der Chirurgie, by von Bruns, Garré and Küttner) and F. Krause (Lehrbuch der chirurgischen Operationen) and in other surgical books.

Confining ourselves to the lower lip plastics, after mentioning the simple vertical sewing together of wedge-shaped defects, and a similar procedure on horizontal ones (Bockenheimer), the methods of Dieffenbach, Langenbeck, Jaesche, Trendelenburg, Sultan, Burow, Blasius, Lexer and Morgan, who all take their flaps from underneath the mouth line, are to be mentioned. Then follow those who take the substitute for the lower lip from above the mouth line (von Bruns (two kinds), Estländer). Israel with his neck flap forms a separate group, as does Lexer with his temporal flap.

Each of these methods has its certain advantages and disadvantages which I cannot detail here. I will only mention that till now not a single one has fully satisfied me—some for logical mathematical reasons, *e.g.*, the simple vertical and horizontal sewing; and the method of Burow for sacrificing too much tissue.

It should be the greatest exception to cut out pieces of sound skin and tissue to facilitate a plastic closure; all the proportions will unneces-

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sarily decrease. There is nearly always a way to be found for applying tissue, which can be spared and taken from the immediate neighborhood for covering the defect in a beautiful and practical way. It is still to be mentioned that the procedures of Trendelenburg, Sultan, and Blasius work in a too narrow circuit to produce a sufficiently large and free under lip. The larger the surface over which the tension difference is to be spread without much cutting, the more satisfactory will the result be.

There still remain the plastics of Dieffenbach, Langenbeck, Jaesche, Lexer, Morgan, Israel, von Bruns (two kinds), and Estländer. Dieffenbach's procedure has proved itself to be a very useful, direct, definitely sufficient method, which is mathematically correct; the deficit is divided over a large space, and the flap is well nourished by the *arteria maxillaris externa*. It only has the disadvantage of deforming the cheek. Also the Langenbeck and Lexer plastics, the one with, the other without, spur, satisfied me, in case of very broad, not high defects, in regard to the cosmetic side, but less on account of the bad movability of the new lip.

Morgan's method I would only use modified, as the sewing of the mouth corners is too unnatural; therefore I combined it with my method mentioned below, in cases of complete lip defects, without practising his sewing together the corners of the mouth.

With high and large lip defects, Jaesche's method is the best, only I made the curve cut much wider and higher, so as to keep the *arteria maxillaris externa* in the centre of it. In this way I approached more the Dieffenbach method, and got the advantages without the disadvantages of both, so that the result was both practically and cosmetically good. This operation had arisen by diminishing the cut in my method for the substitute of larger upper-lip-cheek defects described in "Plastic Operations on War-crippled Soldiers with Indirect Usage of Skin of the Neck to Replace Defects of the Face."

The Israel and Lexer plastics with the neck and temporal substitute give (with the favorable healing conditions in defects with bad nourishment, in which cases a plastic from the neighborhood of the defect was not advisable), in general, a disfiguring result. Near the mouth, the new flap contrasts strongly with its surroundings, and the place from where it was taken is closed with difficulty and disfigurement, so that these operations can only be advised in special cases of bad local conditions.

The cheiloplastic after von Bruns, with almost circular incision round the mouth, nearly from one nostril to the other, destroys too many

vessels and nerves; his other method with two square flaps, rising from the mouth corners, has great advantages, only the scars of the secondary defects, which go up and aslant from the corners of the mouth, are very ugly.

Finally, Estländer's plastic has satisfied me in certain localizations, but a correction of the mouth corner had always to follow.

The shape and place of the defect play a great rôle in choosing the method, and its results much depend on the right choice being made.

My plastic consists in taking a more or less highly-pointed triangular flap with the pedicle at the bottom. The flap is taken either from the nasolabial fold, or also extending higher up between the nose and the

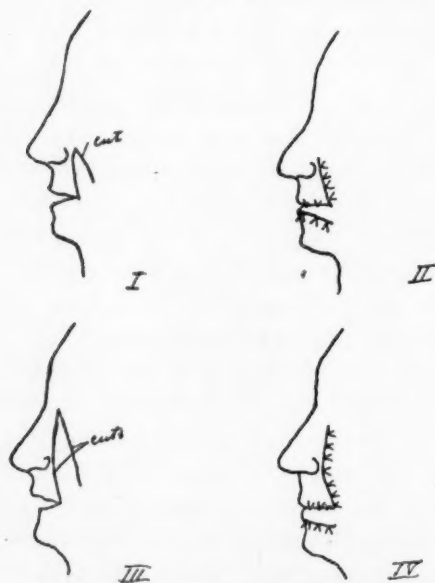


FIG. 22.—The nasolabial flap.

cheek. When requiring mucous membrane the cuts penetrated into the mouth, otherwise more or less muscular tissue was taken in the flap according to the requirements for active movement in the under lip (see Fig. 22). After first completely closing the nasolabial defect, the flap presented itself ready for being placed in the under lip. The flap is used either for a defect or, if the lip be too short or too immovable, is placed in an incision between the red of the lip and the skin.

The advantages of this method are the following:

- (1) The flap contains the entire *arteria angularis* (continuation of the *arteria maxillaris externa*).
- (2) The flap may, if required, supply excellently functioning muscle

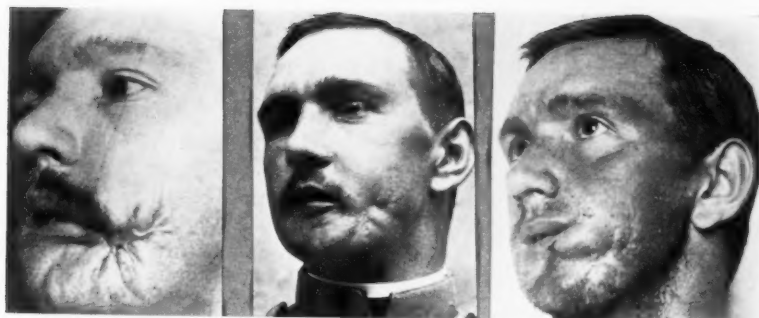


FIG. 23.

FIG. 24.

FIG. 25.

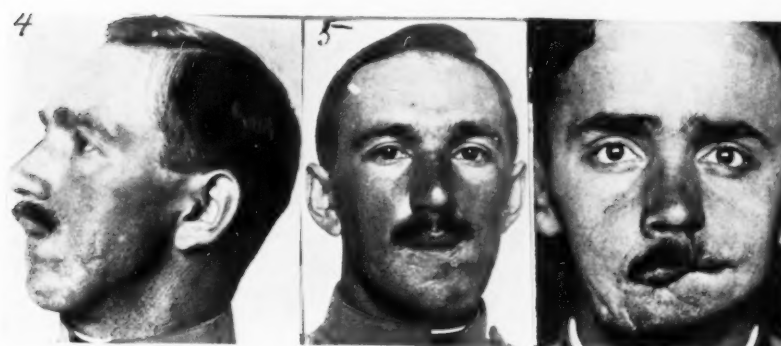


FIG. 26.

FIG. 27.

FIG. 28.



FIG. 29.

FIG. 30.

FIG. 31.

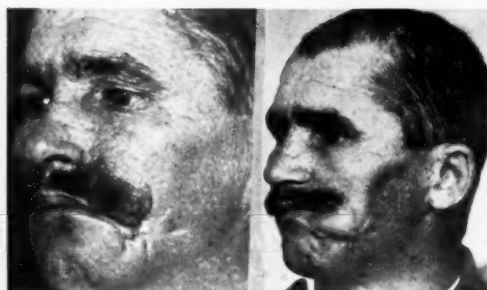


FIG. 32.

FIG. 33.

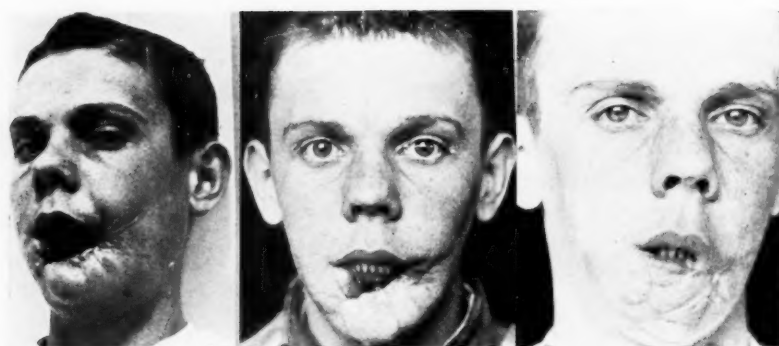


FIG. 34.

FIG. 35.

FIG. 36.

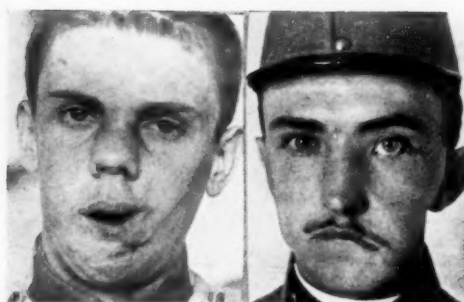


FIG. 37.

FIG. 38.



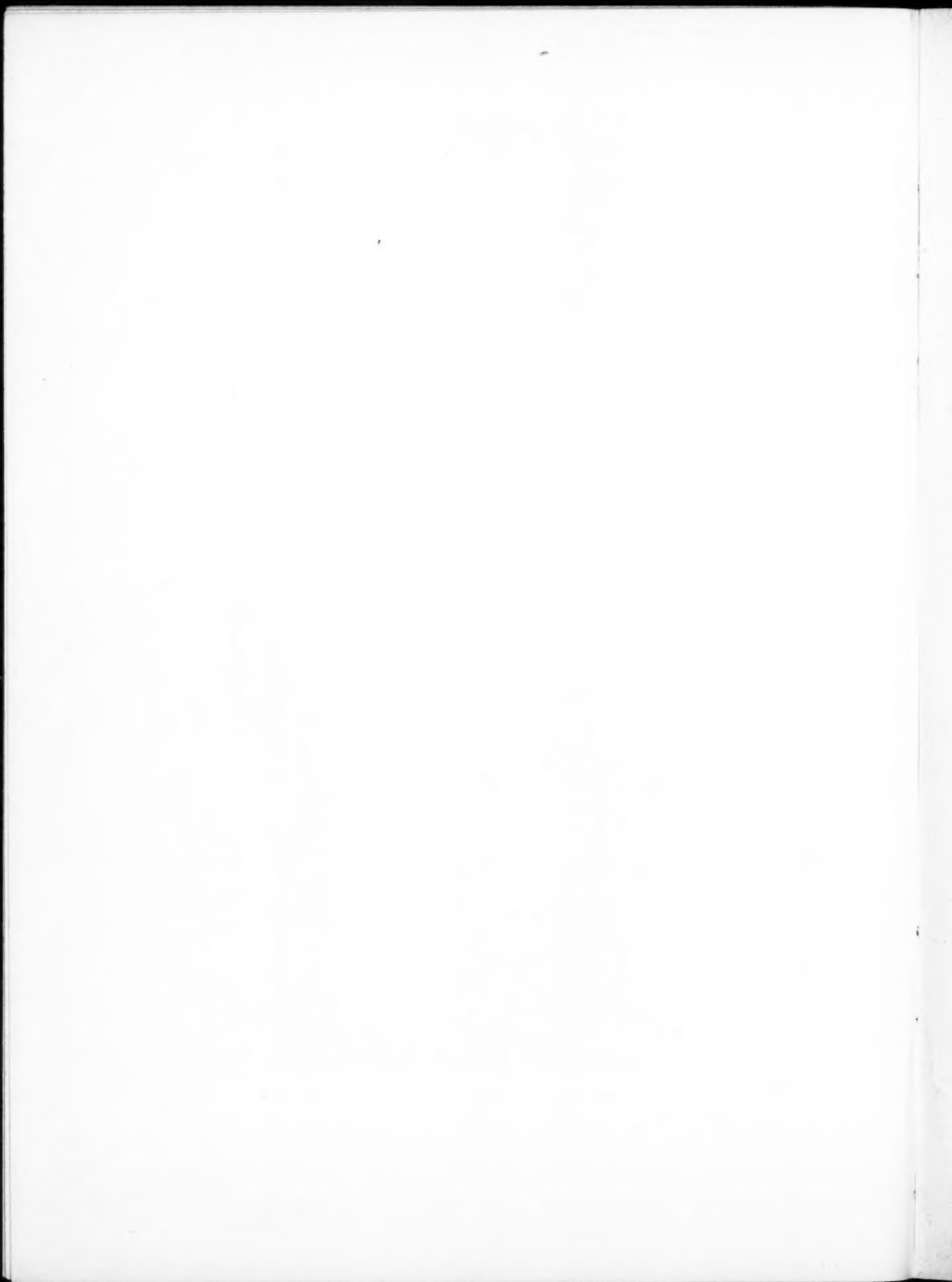
FIG. 39.



FIG. 40.



FIG. 41.



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tissue (muscularis levator angularis) for moving the under lip. (As mentioned above, can considerably improve the Morgan plastic without its corner sewing.)

(3) The sewing together of the secondary defect *disappears exactly in the nasolabial fold*. (Only with very large defects and extensive corrections the flaps extend to near the inner eye corner and then the seam goes higher up exactly in the nose-cheek separating line.)

(4) The upper flap line is sewn together, either with its own mucous membrane (when the flap also contained this membrane) or with other mucous membrane, but *always forms the natural border of the red of the lip*. Only the suture of the much shortened under flap line remains visible after the operation.

(5) In contrast to the somewhat similar method of von Bruns, I can make my operation *either only on one side or on both sides*. In the latter case I have the free choice of the intermediate time. That is because my flap-ends are pointed and easily disappear quite in the lip, while von Bruns's flap-ends are square, and must find another wound edge opposite to join. When I use two flaps (which, however, is seldom necessary) the second flap partly crosses the first. After the complete healing of the first, one has the choice of the size and time of the second operation. It is clear that also the healing is surer than by performing both sides at once.

Here follow some of these mouth plastics made for different reasons.

Soldier D. (Figs. 23-27) (K. u. K. Reservespital Nr. 17 in Vienna), after a shot, had a deep, broadly branched scar at the corner of the mouth, which was drawn much to the side and downward. The scar was deeply spread in the muscles and mucous membrane. The real plastic only followed a preparatory one which removed all the deep scars as far as in the mouth, so that the principal operation could occur later on without entering the mouth. A flap was taken in the manner described, and placed in an incision along the red of the lip.

Of the three seams, only the under one in connection with the little scars of the first preparatory operation underneath it are visible, and can be completely removed later on (see Fig. 37).

As Fig. 37 shows, the flap protrudes a little; this was done purposely, because it is better to be too thick than too thin: First, the secondary defect can be closed more beautifully, when the deep tissue is also removed; secondly, the superfluity of the flap can easily be removed, when after a long time it has not disappeared by the shrinking. A principal thing is that the flap after a long time has enough muscles and does not sink in.

Soldier W. was kindly sent to me for treatment in the Clinic v. Hochenegg, by Docent Dr. Finsterer.

Besides an under-jaw-bone defect, which I also operated (local bone plastic), the patient had a gunshot wound through the left upper and the right under lip. The relatively too large upper lip half was somewhat diminished and drawn by the above described operation, which at the same time raised the under lip and made it more movable (see Figs. 28-31). The remaining prominence of the right upper lip is still to be corrected by a long and deep excision out of its inner side, parallel with the red of the lip.

Soldier D. (Figs. 32-33) (Clinic von Hochenegg). The dentist had made an enlarged mouth by cutting, in order to have more room for his prosthese preparation. Round about the incision there was an extensive growth of scars, so that the left mouth corner was quite immobilized, and, notwithstanding the size of the mouth, speaking, eating and mimic were extremely difficult. The above described mouth plastic corrected them completely. Respecting the protruding of the flap, see remarks on the first patient. The remaining small scars must be removed with the last correction.

Soldier P. (Clinic von Hochenegg) (Figs. 34-37). Here the operation was only a correction after a Langenbeck kind of total under lip plastic, combined with a pedicle flap for mucous membrane substitute. I give here no more details of the first operation but refer to the illustrations. The correction had, as chief object, to make the under lip more movable for speaking and eating; at the same time by lifting the corner, the shape and height of the lip were improved. The patient was not finished after this operation, as the centre of the lip had to be raised. This could be done from the inside of the mouth, as it was caused by the lip having turned inward (entropion), but had not been performed when the last photograph was taken.

Quite another indication was formed with Cadet M., with a very old paresis of the facial nerve. I have also to thank Docent Finsterer for sending me this patient. The same operation was performed, and healed very beautifully, but unfortunately I have only Fig. 38 before the operation and the patient went to the front without being again photographed. The operation had proved its value very well for such cases of paresis.

With the Hungarian soldier M., in the Clinic von Hochenegg, a very successful temporal flap plastic (Lexer) as substitute for the completely missing under lip was made by Dr. Demmer. To correct the too deep immovable under lip he carried out with me a

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nasolabial flap plastic. Here the flap was very long, was also taken from the nose cheek border and was placed nearly along the entire under lip (see Figs. 39-41).

After this operation the patient could eat solid food which had been impossible before. A final correction should be made to raise the end of the flap and the corner of the mouth. A small nasolabial flap from the left side would do; the symmetry would be easily gained and the movement of the left under lip part would improve.

III. THE EPIDERMIC INLAY: NEW WAYS FOR SURGICAL PLASTIC BY USING DENTICAL TECHNIC

For a long time many surgeons have endeavored to obtain a skin covering, by laying on "Thiersch" skin pieces in hollows and on wounds. Still for hollows, these measures were mostly not sure of success, and have not been generally applied, though a keen interest has been taken through many good results. I thought the uncertain results could be avoided by improving the technic, as the bad results were caused by the irregular growing together of the skin and the pieces laid on; so that the complete covering resulted, after a long time, by the growing together of the skin islands where the "Thiersch" had attached.

It was a particular disadvantage that meanwhile a shrinking and cicatrizing through the development of scars was taking place in the granulating surface. Therefore I looked for means for applying the "Thiersch" faultlessly even, and under equal pressure, besides avoiding all infection and increase of saprophytes. This is possible by taking a negative impression of the wounds and covering it with one large Thiersch and placing this, under *equal pressure and immovable* for some days, on the wound. The Thiersch must be everywhere of the *same thickness* and *equally stretched* on the impression form, before this is placed on the wound. After creating aseptical hollows, by cutting under the normal skin adjoining the wound, and after lifting and exactly filling up this with an exact mould, completely surrounded with Thiersch (wound of the Thiersch outwards), the *equal pressure* follows by suture in firm tension of the incision. To prevent infection from increase of *saprophytes*, besides scrupulous asepsis, the greatest care must be taken in preparing the Thiersch. This must be very thin, and as far as *possible free from dead cells* which are always infected, and particularly overladen with saprophytes. Therefore I only use the *inner side of the upper arm*, because the skin is thinnest and most elastic there, and I have the part prepared, thoroughly and most carefully, till the skin is *pink* everywhere.

The Thiersch *suitably large and of equal thickness* can only be cut with *regular success* by great practice; one must always get a *tough, perfectly transparent* skin piece, the thinner the better, especially when it must replace the mucous membrane.

The application of an exact impression of sterilized dentist's impression material and the thorough covering of the same with Thiersch could, after my idea, avoid the dangers and assure a general sure result, if the mould, covered with Thiersch, were placed in the hollow or in the wound, and the opening were sewn firmly together. I carried out this treatment in 24 cases of different kinds, and the result was (with one exception) that the Thiersch healed *quite completely* and perfectly smooth. In the exceptional case, the mould was taken away too soon from a too small opening, and tore the whole Thiersch away. It was an inlay in the under eyelid, in order to enlarge the shrunken conjunctival sac, and in these cases the inlays require a long time to heal, as the tissue under the eyelid skin is very loose and has a weak circulation. It is very difficult to obtain, and to keep sufficient pressure round the inlay in this special region.

Till now I have operated on seven different types, which number may be considerably increased; the types are:

- I. Enlargement of the conjunctival sac.
- II. Construction of part or entire ear.
- III. Enlargement of the mucous membrane of the mouth.
- IV. Enlargement of the hollow of the mouth.
- V. Plastic of the hard and soft palate.
- VI. Preparation for different skin plastics: (a) Inner covering of flaps; (b) former covering of the secondary defect; (c) for both purposes at once.
- VII. Plastic of the urethra.

I. The enlargement of the conjunctival sac is very often required to make room for the eye prosthesis. In these cases the eyelid skin is then cut parallel with the eye slit, higher or lower according to the case; generally scars must be taken away. And now after lifting the upper part of the cut, an impression can be taken (best with the assistance of a dentist) with sterilized wax material. This after hardening is carefully surrounded in the described manner with very thin Thiersch, which is then placed in the wound, and closed with pressure.

The mould must be made in a manner and with such pressure that its size is such that afterwards, on sewing the wound together, sufficient tension results. Before cutting the Thiersch, which only takes place when everything is prepared to receive it immediately, without first

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placing it in a physiological solution, the hard mould must be placed in the hollow and the incision pressed together with the fingers, to see if the tension is correct, otherwise the mould can be altered. It is not practical to enlarge it by adding to it, as the join leaves a line where the Thiersch later on falls in, but it is better to make a new mould if the first prove too small. It is possible to decrease the size, if too large, by cutting before it is quite hard, and softening down the cuts.

The closing under pressure by the sewing is necessary for two reasons—first, the Thiersch is pressed everywhere for quick healing, and second, possible bleeding is prevented. Though I construct the hollows by *cutting* on purpose to open the most possible number of little blood- and lymph-vessels (by all free transplantations I prefer this method to the blunt preparation in general use, because it gives better healing condition). By sewing together under pressure, the small vessels are all closed—only the large arteries must be squeezed or twisted, but not tied, as no foreign substance may remain between inlay and wound. In consequence of the pressure a primary healing of the suture is not sure, but mostly of less importance, as an ugly scar can be easily corrected afterwards. After about two weeks the conjunctival sac is cut parallel to the eye split, and at such a distance from it where the inlay is nearest to the surface. The mould is removed, and the smoothly healed hollow is annexed to the eye-hole in order to receive the eye-prosthese, which must be placed directly, that the still elastic hollow can adapt itself to the prosthese form. It is now clear that the hollow must be constructed everywhere as near as possible to the mucous membrane (see Figs. 42-44).

II. With ear defects, a longer or shorter cut, according to the size of the defect, is made exactly along the hair growth, behind the ear. The skin in front with the periosteum is raised with the raspatorium, as far as the ear, and above and below the cut as required for the defect. The mould of dentical mass (Stent's) of this hollow, after hardening, is completely covered with Thiersch and placed in the hollow. The wound is then sewn together under pressure.

In all cases of this method it is important that the bottom of the wound is made as flat as possible that the Thiersch can be laid quite smoothly on the mould—and as the thin skin is very elastic this can be done without folds, though a fold would not prevent success. In very difficult cases I stick the Thiersch on the mould, and especially when deep tunnels with small openings are to be covered with epithelium, and where the mould with Thiersch must be pushed in with difficulty and under pressure. I stick with white of egg, but other

material may do perhaps. In my opinion the white of egg disappears quickly, and gives the possibility of removing the mould after one or two weeks without it sticking to the Thiersch. In the ear case after one week, the stitches are taken away,—the cut is again opened some days later, the mould removed, the hollow quite split from behind, and this cut enlarged above and below, till the flap is so movable that it can be used for a plastic of the ear. We have then two advantages over a direct plastic. First, the flap is already accommodated to its new pedicle nourishment, also the vessels of the pedicle have grown in that time; second, the flap is completely covered with skin at the back, and the place from where it was taken also, so that the conditions are not only advanced, but also clean.

III. The enlargement of the mucous membrane of the mouth often occurs in jaw injuries, or with patients who have retained, after extensive inflammation, scarred contractions of the mucous membrane, as with a patient in the "K. u. K. Reservespital, No. 17," where in consequence of intensive scorbutus, an inflammation of the gum and suppuration of the jaw, with ejection of sequestrum, arose and which healed with such a diminished mucous membrane, that the red of the under lip had grown to the jaw everywhere, and the entire fornix, on the sides, as far as both masseters had disappeared. In this case I made a vertical incision in the skin of the middle of the under lip, under the red part, and prepared from there to the left and right under the skin, in 3 inches depth and more than a thumb width, two hollows, which were filled with stents covered and stuck with Thiersch in the manner above described. A fortnight after, a cut was made inside the mouth, from one masseter to the other on the thinnest covering line of the stents, first with the knife, and after removing the inlay, the cavity was laid quite open with the scissors, which of themselves find the thinnest line of the cut. An impression of the under jaw was immediately taken, which had naturally not been possible before the operation, as one could not get down to the front surface; and immediately afterwards a prosthese was constructed (with all the teeth, which had been lost in consequence of the illness) and placed in the mouth. The under lip, which had formerly been perfectly immovable, had at once regained its use, both for speech and mimic. In other cases where the upper and under lip were curled inwards, the inlay was placed parallel with the mouth orifice, the same also removed after making a parallel cut in the mucous membrane. At both ends mobilization cuts were made so that the cavity formed could spread itself in an epithelial surface.

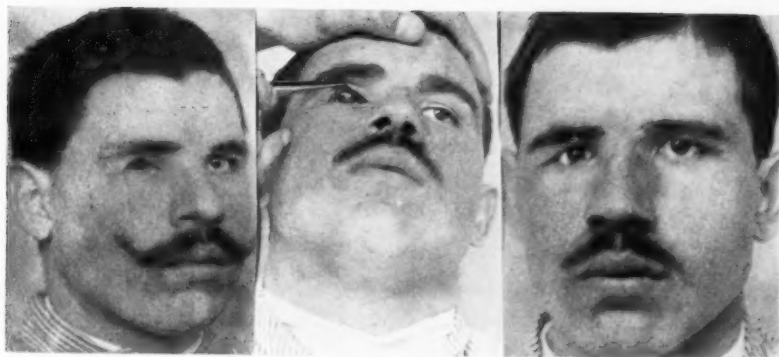


FIG. 42.

FIG. 43.

FIG. 44.

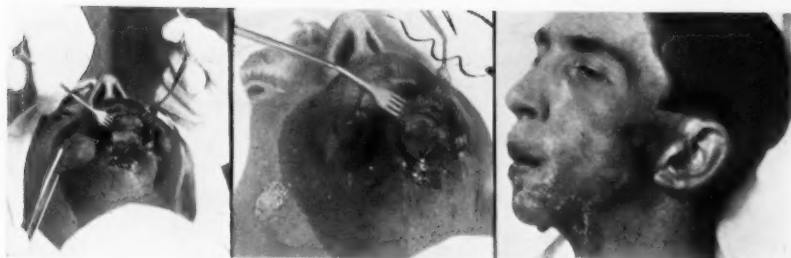


FIG. 45.

FIG. 46.

FIG. 47.

FIG. 48.



FIGS. 47 and 48.—Showing the procedure of "epidermic inlay," with the stents piece and the opened hollow entirely epithelized.

FIG. 49.—Patient after being operated (removing all scars and making the epidermic inlay). The sutures are not yet removed.

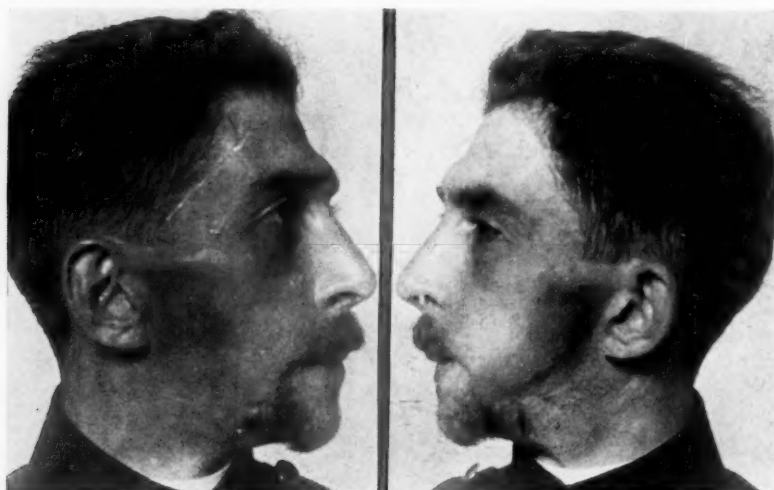


FIG. 50.—Patient with a maximal filling of the hollow with gauze in order to show its size.

FIG. 51.

FIG. 52.

FIG. 53.



FIGS. 52 and 53.—Patient finished—the centre of the under jaw being replaced with a rubber lump of desired size and fixed in the definitive dential prosthese.



FIG. 54.

FIG. 55.

FIG. 56.

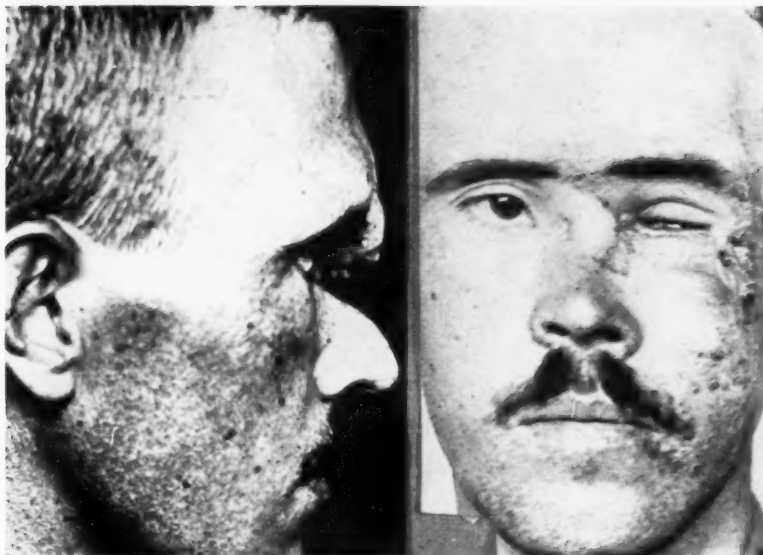


FIG. 57.

FIG. 58.



FIG. 59.

FIG. 60.



FIG. 61.



FIG. 62.



FIG. 63.

PLASTIC SURGERY OF THE FACE

IV. The enlargement of the mouth cavity is often necessary in normally large mucous membrane surfaces, if the tongue is so scarred at the front base as to affect speech and swallowing. In the same way as with the eye and ear plastics of this system, after removing the scar, a cross cut is made and a space formed, which is filled with stents mould, covered with Thiersch and then sewn together. Here also as with all such intra-oral plastics (contrary to my usual practice in order to avoid as far as possible the antiseptic), I have followed Professor Weiser's most emphatic advice, and put a layer of iodine gauze between the stents and the Thiersch. I have been very satisfied with the result. A still more frequent occurring indication lies in large bone defects of the centre of the under jaw, the so-called "bird face."

By cutting the outer skin, all inner scars in the case depicted in Figs. 45 and 46 (F., K. u. K. Res. Spit., 17, Vienna) were completely removed, and besides by internal enlargement, always working through the outer cut, a cavity was formed by pushing the jaw pieces apart, which when filled up under pressure presents normal anatomical conditions to the jaw line. This is not always possible without cutting the mucous membrane in vertical direction. When the elasticity of the membrane cut allows, this is sewn together horizontally, otherwise closed with a flap or left open, as an uncovered epidermical inlay, even in the mouth, may heal, but is not quite certain. After filling the cavity with stents mould, covered with Thiersch, ten days later this piece is removed, after cutting on it in the inside of the mouth. The cut enlarged with the scissors, as described above. Then the dentist, who must be present, takes an impression and quickly prepares a temporary prosthesis without teeth. This must be exchanged later for the definite prosthesis with teeth. This prosthesis has to perform the following uses: To fill up the cavity, giving normal anatomical lines, and to support and connect, as in one piece, the jaw. The patient then looks quite normal and can always submit later to a bone plastic, whereby the soft tissues through their stretching and accommodating themselves to normal position offer better conditions for a bone plastic than was before. I speak here of patients who refuse a bone plastic, or of those who do not at present come into consideration. I show Figs. 45-49 of the proceeding so as to make easier to understand the method.

In palate plastics, particularly on hard palate defects, even of very large dimensions, this proceeding is of great value, as it not only considerably improves the prognosis of children born with divided palates, but also makes operations on very great defects possible, which were formerly considered practically inoperable. Case R, which I operated in the clinic of Professor Onodi (Budapest), belongs to the latter.

The mode of procedure is in a similar way as by Lane, but again more advantageous for the two reasons already mentioned in the ear plastic. First, on turning flap the same is everywhere skinned over and also the place from where it was taken, and besides the mouth clean. Second, for one or two weeks the flap has become accommodated to its new nourishment conditions, and the same has improved in the pedicle. In this interval the flap had no chance of shrinking or becoming infected, as in the procedure proposed by many surgeons, to perform the Lane operation in two instead of one treatment. Neither can granulations develop and cause later shrinking, which would in any case influence later the nourishment conditions and reduce the resistance and the bone growth of the periosteum flap.

According to the size of the defect, one makes at a greater or less distance from the defect, a curved cut on the processus alveolaris, through the gum and periosteum, raises it with the raspatorium, takes the impression, etc. In the second operation, after one or two weeks, the seam is again opened, enlarged above and below, till the flap is sufficiently mobile (naturally as little as possible, as the nourishment does not come from the centre of the pedicle but from the upper and under side, *vide* anatomy), then cut along the edge on the other side of the defect, and undermine till the turned flap, without being diminished, can be quite taken up (Lane). Then follows excoriation of both sides of that part of the flap which is to lie in the new wound and to be completely covered, then stitched. The sewing is in such a manner that the stitches which fix the turned flap edge into the depth of the wound are in pretty parallel line with the slit in palate. The second seam connects the free-made cut edge to the massive part of the over-turned flap.

Dr. Demmer (at the present time chief assistant in the clinic v. Hochenegg) has also successfully carried out my method, even in a very wide, totally double-sided slit of hard and soft palate.

V. The preparation of skin plastics has, first, the purpose of providing a flap with an inner covering of Thiersch where it has to cover a cavity, viz., in noses, eyes and mouth, second, for previous epithelialization of the place of removal of the pedicled flap, and, third, very often when wishing to combine simultaneously both the mentioned purposes. Such was the case with First Lieutenant K., in the clinic of v. Hochenegg, where a nose skeleton and soft part defect lay in the middle of the nose. Here, over the defect, an "epidermical inlay" was placed so that the pedicled flap, before being turned, received a skin covering on the inner side (Figs. 54-58).

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Another case, R., in the K. u. K. Reservespital, Figs. 59-62, had a large under-lip defect. With this patient three chestnut-sized inlays were made; under, to the right and left of the defect, but not only to cover the inner part of the flap, but also under the chin to cover a secondary defect which would arise there.

VI. For strongly pronounced hypospadias this procedure is quite suitable, as shown in two cases in v. Hochenegg clinic, where in one case the urethra opened in the centre of the cloven scrotum. Finally, by pretty complete urethra plastic, I have applied an apparently similar, but in reality quite different, treatment. Instead of creating a cavity, or in this case a tunnel in the desired form, to take an impression of it, etc., I followed the contrary proceeding, which is not to be recommended except in this case. It would have been technically most difficult to take an impression of so long a tunnel without splitting the outer covering. Therefore I previously took a very wide rubber drainage-tube, 8 inches long, and made the tunnel freely according to the size of the tube. From a little cut on the perineum, a tunnel was made chiefly blunt under along the scrotum to the end of the præputium, by first pushing a trocar, then always thicker blunt instruments, till finally the handle of an elevatorium passed through the whole tunnel. It is clear that this work is more incorrect and in general cannot compete with the above-mentioned method; yet in this case I succeeded completely. I may mention that I split the rubber tube lengthwise, covered it with white of egg, let it dry, then cut the Thiersch in one piece, dried the same on the outer side of the skin, laid it along the tube so that the overturned parts joined on the split and were brought in and hidden in it. The result was a perfectly smoothly covered drain-tube, the Thiersch stuck on it with white of egg, and besides the edges were held fast in the split which had the inclination to close together; when introducing the tube into the tunnel the possible danger of rubbing the skin off the tube, which increases with the greatness of the pressure round the tube, will also diminish with it as the split is more firmly pressed together, and keeps the skin in its place. Also in this case (clinic v. Hochenegg) the flap, which was 8 inches long and 2 inches broad, healed completely. (See Fig. 63.)

By this method the following points are to be especially borne in mind:

(1) Correct choice and formation of the cavity, where care must be taken that when later on this is to be opened elsewhere, for instance, in the inside of the mouth, the epithelialized cavity has, as covering, the

least tissue possible there, so that only a very thin layer of the same must be cut; for this cut surface is not epithelialized and with time could become a very large scar.

Also the back part of the cavity must be as straight as possible, that the Thiersch may more easily be laid round the mould without creases. Of course the back of the mould must be laid in the centre of the Thiersch. The space should in a certain measure be funnel-shaped, that the first and last impression may be removed, and the skin-covered mould can be pushed in. Although a perforation of the wall must be carefully avoided, the Thiersch can bear much, and always heals quite smooth, even near chronic suppurations which are only dispersed with difficulty. I never saw a rise of temperature in the whole of my 24 cases. Once, in one case a necrose appeared on a very small part of the flap edge, and even the Thiersch round about it healed completely on the flap.

(2) The skin should be prepared only with tincture of iodine and careful avoidance of any other moisture. The skin is to be freed of all dead cells by thorough shaving, without soap or moisture, and then the Thiersch cut equally very thin, in one piece of the necessary size. It is important to cut the Thiersch only when its reception in the cavity can take place immediately, that this (as I rarely lay it in a physiological salt solution) can be laid at once around the mould and does not dry up on its wound surface.

(3) The mould should be very exact, and so large that the edges of the wound can be brought together, although it is of no essential disadvantage if the seam gapes even in the beginning.

(4) The stitches must be strong, and deeply taken so that they do not tear too soon.

(5) One must have patience before beginning the second operation; especially with tissues which are vascularized badly and are flaccid, for example the eyelids, so that they do not remain stretched over the mould, but will expand and slacken. With good technic the "epidermical inlay" is a sure procedure which may be still further used for new groups.

The seven named groups are all represented in my operations, but this method can be applied in many other cases, *e.g.*, for covering bone cavities, soft part defects; if a mould covered with Thiersch is put on the wound and pressed and fixed there, instead of being sewn. Professor Weiser used this variation of my method with good result for covering wounded surfaces inside the mouth. To keep a constant pressure with the mould on the Thiersch, he perforated the mould as well

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as the cheek with a kind of flat-headed nail, head in the mouth, and the projecting end was previously prepared to hold a nut, which pressed against a perforated plate, between which and the cheek iodine gauze was wrapped so thickly that the mould was firmly pressed on the Thiersch. The whole construction was very fine and functioned very well.

To make an outward auditory passage, this procedure can be used to prevent two parts from growing together, or to prevent definitively an existing growth. With penis skin or vagina plastics, even with bladder plastics, also rectum plastic, *e.g.*, when after extirpation of a rectum carcinoma an anus sacralis is laid on, the removed piece of intestine can be replaced by an epithelized cavity, which when perfectly ready, is bound on the one side with the central rectum piece, on the other with the sphincter, if it is still left—if not, it can be combined with a sphincter plastic (Schoemaker or other methods).

With carcinoma oesophagi the upper part of the oesophagus can be connected with the stomach with the "epidermical inlay" outside the chest, instead of the usual skin plastic, which is less sure.

In general the Thiersch application as substitute for mucous membrane has an important advantage, as the Thiersch accommodates more easily to the mucous membrane conditions, and undergoes a kind of successive membrane transformation, than is the case when using the entire skin with its complete skin formation, glands, etc. The skin in such conditions goes through a long stage of inflammation or eczema, while the Thiersch only shows particularly strong scaling in the mouth and eye cavities at the beginning.

TRAUMATIC ANEURISM OF THE TEMPORAL ARTERY*

By J. SHELTON HORSLEY, M.D.

OF RICHMOND, VA.

A TRAUMATIC aneurism, according to Matas, is an aneurism that results from a trauma to a healthy artery. It is not very common and should not be confused with the so-called idiopathic type of aneurisms that occur in diseased arteries. Sometimes in the idiopathic type there is a history of a slight trauma or strain which precedes the formation of the aneurism. However, such an injury, which would be insufficient to damage a healthy blood-vessel but will produce an aneurism in a diseased artery, is not the chief etiological factor. It is only when traumatism is the sole cause and when the blood-vessel was healthy up to the time of the damage that the resulting aneurism can be termed traumatic. Instances can be imagined in which injury to a healthy artery may produce a weakening of some of the coats of the vessel and cause a pouch formation somewhat similar to the protrusion of an inner tube when the outer tire has given way, but, as a matter of fact, probably all traumatic aneurisms are caused by a direct arterial injury that results in a hæmatoma. A true traumatic aneurism, then, may be described as one that results from the organization of a hæmatoma produced by an injury to the wall of a healthy artery.

What probably takes place is that the trauma produces a rupture of the artery, and an extensive hæmatoma is formed, which by its pressure prevents further bleeding, but the force of the arterial stream produces a pocket or lake in that portion of the hæmatoma nearest the injured artery. This lake becomes lined with endothelium, and later a supporting framework of connective tissue, corresponding to the adventitia of the blood-vessel, is gradually formed while the rest of the hæmatoma is being absorbed. In most instances where a healthy artery is ruptured, the patient either bleeds to death or the artery is occluded by a thrombus from the pressure of the hæmatoma. It is the exceptional case in which one of these things does not occur, and here a traumatic aneurism forms, unless an injury to a vein causes a communication with the vein. We can merely speculate why it occurs at all. In dogs, where clotting of blood is very prompt, it is practically impossible to produce a traumatic aneurism. In man several conditions may promote it: the injury to the artery may be done in such a manner

* Read before the Southern Surgical Association, December 12, 1916.

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that a flap of intima is formed; a hæmatoma may occur in such a way as to produce a mechanical effect on the blood stream that is most likely to cause an eddy; or there may be a deficiency in the elements of the blood or tissues that produce prompt clotting. The rarity of these conditions evidently accounts for the uncommon appearance of traumatic aneurisms even in exposed vessels.

The temporal artery, or as it is called by Gray, Piersol and others the superficial temporal artery, is one of the two terminal branches of the external carotid, and though smaller than the internal maxillary, the other terminal branch, its course is practically a continuation of the external carotid; consequently, it receives the full force of the direct current. The temporal artery begins in the substance of the parotid gland behind the neck of the condyle of the lower jaw, crosses over the root of the zygoma lying on the temporal fascia, and divides about two inches above the zygoma into an anterior and a posterior temporal branch. It gives several branches from its main body, twigs to muscles and to the parotid gland, the transverse facial, middle temporal, orbital, and anterior auricular. The anterior temporal runs tortuously upward and forward on the forehead. The posterior temporal, which is somewhat larger, curves backward and upward along the side of the head. The temporal artery itself and its terminal branch, the anterior temporal, are very superficial and are much exposed to trauma. The posterior branch is usually protected by the hair and a hat or cap. The temporal artery and its continuation, the anterior temporal, lie close to the skull, and rest on the temporal fascia and pericranium of the skull throughout most of its course. A blow upon either of these arteries would drive it against the skull with but little protection of soft tissue either over the artery or under it. It seems remarkable that serious injuries to these temporal vessels are not more frequent, especially in children and athletes where bumps and blows on the head are such common occurrences.

Since 1896, during the past twenty years, a rather thorough search of the literature has shown only five cases of traumatic aneurism of the temporal artery and its branches. A brief abstract of these follows:

O. MANZ (*Beitr. z. path. Anat. u. z. allg. Path.*, Jena, 1898, xxiv, 531) records the case of a sailor twenty-five years of age who received a blow from the fist in the right temporal region, and two years later examination showed a small globular tumor under the skin. The tumor had developed during the past two years and had attained the size of a hazel-nut. It pulsated distinctly. It involved the bifurcation and upper end of the right temporal artery. The sac was excised after ligating the arteries on each side of the aneurism.

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GEO. H. EDINGTON (*Glasgow M. J.*, 1903, ix, 213) reports the case of a boy fourteen years old, who was wounded in the right temple by the bursting of a soda-water siphon. There was a small punctured wound which bled profusely. One stitch was taken to stop the bleeding. Several days later a pulsating swelling appeared where the temporal artery crossed the right zygoma. It was spherical, about three-quarters of an inch in diameter, and presented expansile pulsation. On the apex of the swelling there was a small wound almost healed with a stitch in it. The aneurism was operated upon, the artery being ligated above and below the sac, and the sac excised. It contained a dark clot which on removal left a smooth interior of the sac that communicated with the temporal artery by a small aperture.

H. MORESTIN (*Bull. et mém. Soc. anat. de Par.*, 1912, lxxxvii, 420) reports a traumatic aneurism of the temporal artery in a patient forty years old who was injured in the right temporal region as a result of an automobile accident. The bleeding was arrested by compression and dressing. Several days later a small round mass formed under the scar and gradually increased in size. The skin appeared normal and could be moved over the growth, which was about the size of a large pea. There was distinct pulsation, synchronous with the radial artery. The aneurismal sac was excised after ligating the artery on both sides of it. The sac when removed had a cavity with uniformly thickened walls into which the ends of the artery opened. It involved the frontal or anterior temporal branch of the temporal artery. According to Morestin, aneurisms of the small superficial arteries of the head are very rare.

E. HOLZWARTH (*Pester Med.-chir. Presse*, 1915, li, 64) records the case of an officer who, in August, 1914, received a gunshot wound. The projectile penetrated the middle portion of the left zygomatic arch, the point of exit being on a level with the auditory canal behind the ear. He lost much blood and a large hæmatoma formed in front of the ear, which evacuated itself a few weeks later through the external auditory canal. Since then he noticed constant blowing sounds that increased on exertion. Three months ago there was marked dilatation of the temporal artery and its branches. The temporal artery was dilated cylindrically in front of the ear. There was pulsation and a blowing bruit. The upward branches were also dilated. Holzwarth demonstrated the case as one of unusual rarity, a case of aneurism of the temporal artery from a gunshot wound.

At the same meeting DR. THEODORE HÜLTI presented a patient who had six weeks previously sustained a contusion of the head from a fall. Five centimetres from the outer angle of the eye there developed an increasing tumor with fluctuation and pulsation.

The following two cases of traumatic aneurism in the temporal arteries which have occurred in my practice were both in youths whose previous health had been good, and in whom there was no history of either acquired or hereditary syphilis. As the aneurisms in both cases followed severe traumatism, which at once produced large hæmatomas, they may be taken as examples of traumatic aneurisms in previously healthy arteries:



FIG. 1.—Drawing showing the location and appearance of the traumatic aneurism in Case I. The aneurism involves the first part of the anterior temporal artery.

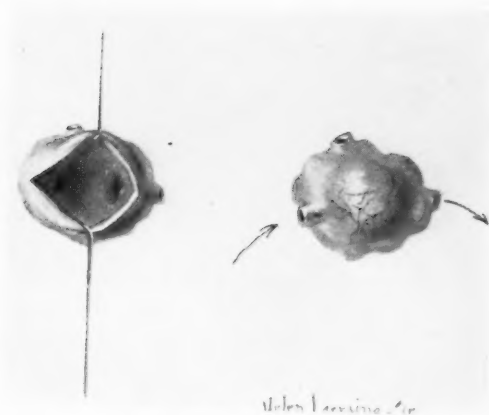


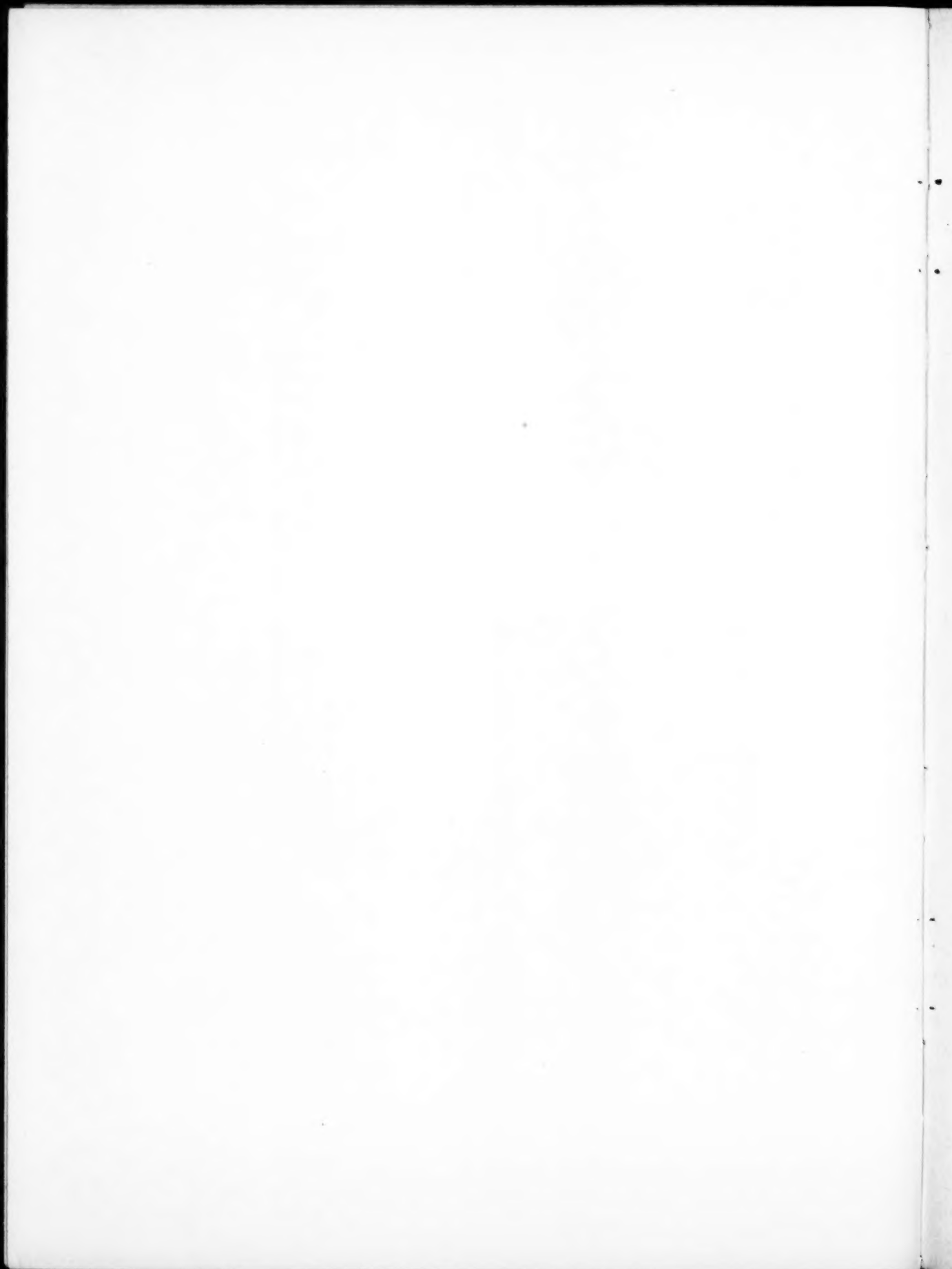
FIG. 2.—The sac of the aneurism in Fig. 1, after its removal.



FIG. 3.—Case II, showing the traumatic aneurism of the temporal artery.



FIG. 4.—The sac of the traumatic aneurism in Fig. 3, after removal.



TRAUMATIC ANEURISM OF THE TEMPORAL ARTERY

CASE I.—H. G. P., aged nineteen years, white, male. Family history has no significance.

The patient has had the usual diseases of childhood; also pneumonia and typhoid fever. He was well nourished and in good general health. He had never had any venereal disease, and there was no history of hereditary syphilis.

While playing basket-ball in November, 1914, he was struck in the right temporal region. This was followed by very marked swelling which gradually disappeared. The skin was not broken. A few weeks later a small circumscribed growth about the size of a buckshot appeared on the right side of the forehead, about two inches above the zygoma. Pulsation in the growth was soon observed. It gradually grew until it became about one-half an inch in diameter. Since May 1, 1915, the pulsation has been more marked. Operation was done June 12, 1915. An incision was made under novocaine, and the sac dissected out. The artery was ligated above and below the aneurism and the aneurismal sac excised. It seemed to be in the first portion of the anterior temporal. The patient left the hospital two days after operation. There has been no recurrence.

CASE II.—E. M., aged nine years, white, male. There was no history of syphilis in either parent. There were two children, both healthy. There was no history of miscarriages in the mother. The boy has had the diseases peculiar to childhood. He was operated upon for adenoids four years ago. In March, 1916, while wrestling, he was struck on the left side of his head by a boy's shoe heel. Considerable swelling followed which gradually disappeared, and a small lump formed just above the zygoma on the left side. No pulsation was felt in this lump until May, 1916. After this time the growth, which was about one-half an inch in diameter, began to pulsate. On exertion the pulsation became so marked that it was disagreeable to the patient. Operation was done under local anæsthetic on May 26, 1916. A transverse incision was made and the aneurismal sac was excised after ligating the temporal artery below and above the sac. There were three arterial branches from the sac. The sac sprang from the temporal artery just above the zygoma. It contained a small clot which was partly adherent. The patient left the hospital the following day, May 27, 1916, and made a satisfactory recovery. There has been no recurrence.

THE TREND OF SURGERY IN EMPYEMA OF THORAX*

BY MARTIN W. WARE, M.D.

OF NEW YORK CITY

ADJUNCT SURGEON TO MT. SINAI HOSPITAL

(From the Surgical Service of Dr. Howard Lilienthal at Mt. Sinai Hospital)

It is characteristic of modern operations that they conform more and more to a constant type. The operation for empyema of the thorax, however, thus far, has been "variant" rather than "constant."

The precision attained in intra-abdominal operations and the resulting efficiency therefrom was evolved from exploratory incisions. It therefore lay in the nature of things that when analogous methods were applied to intrathoracic conditions, greater efficiency in results would also become prevalent. That thought but fleetingly suggested itself to the minds of several pioneer workers in intrathoracic surgery. By and large, empyema, acute and chronic, is the most common thoracic pathological condition demanding surgical relief. Yet the operation for empyema, strange to say, was not forthwith slated for the benefits that followed the newer methods of intrathoracic exploration.

The early recognition, the correct method of attack, the abbreviation of hospital internment, lower mortality were always engaging topics for discussion in acute empyema, and the climax was attained in the controversy that has waged to this day, in the cure of relapsing empyema and the thoracic fistula, by the operations, overwhelming for the patient and surgeon alike.

Dr. Howard Lilienthal's impressions constitute the most advanced thought on the topic under discussion. Little more than a year ago, at the American Surgical Association, June 11, 1915,¹ he said, "In my other thoracic work, I had noted the wonderful exposure by wide rib retraction through a long intercostal incision, and I adopted this operative principle as a primary evolutionary move, etc." This it should be noted is a precise enunciation of a principle visualized and executed and bids fair to mark an era in coping successfully with empyema in a constant way.

The older operative procedures familiar to all surgeons preclude

* Read before the Surgical Section, New York Academy of Medicine, December 1, 1916.

SURGERY IN EMPYEMA OF THORAX

their mention. This comment alone, however: that the multiplicity of methods of dealing with acute empyema so often the forerunners of chronic empyema and fistula and the variegated plastic operations for their cure, constitute the most damaging testimony to the lack of satisfactory routine.

In a very searching article on "Surgery of the Chest,"² Kuttner (1912), speaking of thoracotomy, says, "That for purposes of evacuation of pus in the chest, thoracotomy has passed into the background, whereas rib resection occupies the centre of the stage, and that the simple intercostal incision is only an emergency procedure practised where the operator has not the necessary instruments at hand, or is not conversant with the technic. While thoracotomy for evacuating pus is decidedly waning, thoracotomy for the exposure of thoracic viscera, with the aid of differential pressure and perfection of asepsis, is rapidly gaining ground. These latter thoracotomies are effected with a large incision."

By this last remark Kuttner's injunction against thoracotomy for empyema falls to the ground, since his conclusion is erroneously based on a comparison of small thoracotomy versus the large. And we would add in the light of our experience that the intercostal incision is not an emergency procedure, and that for its proper execution, it also requires proper instruments, as will be referred to later on.

Elsewhere Kuttner reverses himself in his endorsement of Sauerbruch's endeavors to cure recent empyema, *with thoracotomy*, without drainage tubes under differential pressure, after as well as during the operation. Sauerbruch reports several successes. It is of interest to cite the procedure of Sauerbruch: "Under differential pressure the lung expands and forces the pus to escape through the thoracotomy wound. All pus is thus evacuated at one stroke and the surface of lung expanding comes in contact with the chest wall. No drainage nor tamponade, and air-tight gauze dressings were changed after three to four days in pressure chamber. In two uncomplicated instances, the lung was adherent to the chest on the sixth and seventh day. Subsequently two to three weeks more may be required to heal the granulating wound. Such ideal healing does not always ensue. Often the lung does not yield by expanding readily to the intrabronchial pressure and a few more dressings may be required."

But with all that Sauerbruch is of the opinion that the course of healing is abbreviated and less complicated than usual. The procedure has the endorsement of Kaush, Karewski, Heller, Goebel, Wendell and Hoffman, also in chronic empyema.

It is very patent that Sauerbruch endeavors to make out a case for the "Differential Pressure Chamber," whereas between the lines may be read that the expansibility of the lung is fundamental.

Now the Delorme-Fowler operation of decortication with Ransohoff's modifications, too, is based on the expansibility of the lung, after it is freed of the constricting exudate. But perusal of the cases so operated upon discloses that this happily conceived operation repeatedly fell short of its mark, we believe, because the method of approach through a trap-door incision was inadequate to the proper performance of the same in every instance: and when executed by multiple rib resections, as suggested by Lloyd, the operation for empyema was a combined thoracoplasty and decortication.

All of the remedial measures for empyema of the pleura are essentially decompressing operations: that is to say, decompression of the lung with the incident restoration to normal or obliteration of the interpleural space and elimination of any dead spaces. A due appreciation of this objective is what we aim to effect in advocating the abandonment of the categorical rib resections with the cut-and-dried tube drainage of empyema.

Over our predecessors in this field of work we have the immense advantage of the use of X-rays. We have come to regard the aid of X-rays as a "*sine qua non*." In every instance, save where the urgency of the situation precluded (such as great intrathoracic pressure) and also where, owing to the lateness of the hour, X-ray service was not available, all patients were X-rayed. Most valuable information as to location and extent of disease and point of attack, type of operation and prognosis were at once turned to account. Guided thus by the X-ray findings in all instances, a preliminary confirmatory puncture and aspiration is performed just prior to the performance of the operation. On the other hand, we would emphasize that diagnostic exploratory punctures be abandoned at the bedside, in favor of the confirmatory puncture constituting as the latter does one of the steps of the operation.

In the case of very sick patients, particularly young infants, an aspiration alone may constitute the first step of the operation, to be followed forthwith, or at the earliest opportune moment, by the simplest possible tube drainage through an intercostal space. The skin anesthetized by ethyl chlorid spray or novocaine 1 per cent. is incised amply to permit intercostal puncture with trocar and cannula; and advancing a 20 F. catheter, with several openings at the tip, for a very short distance through the cannula, which is now removed. Uniformity of drainage other than siphonage while the tube was in place in the

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small wounds, particularly in children, was facilitated by some form of negative pressure.

The apparatus suggested by Perthes³ on the lines of Sprengel vacuum pump system permits separate collection of pus. As the amount of pus diminishes and changes to a serous character and the temperature falls, the tube is removed. A departure from such normal convalescence calls for an X-ray, on the findings of which further operation may be predicated, such as minor intercostal thoracotomy, which we choose to so designate, to distinguish it from the added features which characterize the "major thoracotomy" and "lung mobilization." Detailed features of these have been elsewhere mentioned originally by Dr. Lilienthal and subsequently in a joint publication.⁴

In his recent report of 300 cases heretofore operated on in the various services of Mt. Sinai Hospital, Dr. Wilensky⁵ emphasized that rib resection was the routine. In our cases, minor thoracotomies preponderate. This should not signify any vindication of nor identity with the older practice of intercostal incision. Minor thoracotomy actually came to be a matter of incidence as a preliminary step in the development of the operation herein designated "Major Thoracotomy" and "Mobilization of the Lungs." As a retrospect covering two years' work in unselected cases, totalling nearly one hundred, these addenda are offered.

The proper posture for a good exposure to facilitate the operation is of the greatest importance. It is managed by placing the patient directly on the sound side, if local anæsthesia be employed; but under general anæsthesia the patient should be placed on the abdomen. In the lateral posture, the tilting of the trunk to either side of the table is obviated by flexing the thighs as in Sims's position with a pillow between the knees, and thus, with the aid of the pillow or the adjustable bridge of the table in the iliocostal space, the trunk is forced into scoliosis. The division of the chest wall should be executed with great expedition so that most of the time be available for intra-thoracic work.

With thoracotomies, minor and major, hemorrhage from intercostal vessels is obviated by cutting close to the upper margin of the lower rib; next there is no delay in isolating the vessels for ligature, with the incident risk of slipping of the same and secondary hemorrhages. Abandonment of routine rib resection materially shortens the operative procedure and lessens shock; the wound conditions are simpler, and healing is very much more prompt, since the complication of sinuses dependent on the osteomyelitis of one or more resected ribs

has disappeared. Following "minor thoracotomy" there is never any necrosis of the ribs nor bony bridges from regenerated periosteum after complete healing, and the resultant cicatrix is cosmetically less obtrusive, and it is by no means to be overlooked that the scoliosis following rib resection rarely if ever makes its appearance.

Encapsulated empyemas are in a class by themselves, and wherever diagnosticated in advance by X-ray are treated by resection of one or more ribs, inclusive of the periosteum and the abscess cavity tamponated.

Drainage.—If the thoracotomy be large enough, drainage without tubes, gauze or rubber dam is as effective as with rib resection; and, when drainage appears to be inadequate, the cause therefor lies deeper, intrathoracically, such as interlobar collections, those between diaphragm and lung, or even juxtacardial or intrapulmonary abscess or bronchiectasis. All of these can be attacked through an enlarged thoracotomy "en route" to the performance of the "mobilization." Drainage was effected by inserting as short a tube as possible, and its removal at the earliest moment, guided by defervescence and diminished secretion, eventually controlled by X-ray examination. In the thoracotomies of larger dimension often no drain whatever was employed, or at the most, a small piece of rubber dam. In adults the more powerful vacuum suction pump was intermittently applied only to evacuate the pus, and where called for posture most favorable to the freer flow of pus was assigned. Lung expansion was fostered by forced respiration with James's bottles or blowing up balloons, and roof dwelling was reserved for the more debilitated patients. Also mild physical exercises were instituted.

From the aforesaid it follows that routine has given way to rationalization of treatment in empyemata. This implies availing ourselves of all resources, operating strictly according to indications, attaining thereby greater efficiency as witnessed in quicker healing; lessened hospital domicile; lessened number of operations; less mutilation; *no operative deaths*, and a somewhat lower total death-rate by 5 per cent.,⁴ which we hope still further to reduce. The thoracic fistulæ and thoracoplasties, alike so mutilating and so mortal, and which used to be so numerous, much to the discomfiture of all statisticians (those of Dr. Wilensky placed at 23 per cent.), have been completely eliminated. Thus we believe to have fulfilled the longing for an improvement culminating in this signal gain—the passing of thoracoplasties. The late recognition of empyemata is due to inherent difficulties of diagnosis and is accountable for their tardy delivery to the surgeon and the resulting untoward results in so large a number.

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As a means to the end of lowering the mortality, it is mete at this juncture to petition the internists to adopt a like attitude for empyema as they at present assume in appendicitis, calling upon the surgeon the moment the existence of empyema is entertained, so that while the diagnosis is *sub judice* and in the making, they may jointly pass upon radioscopic findings and radiograms upon which confirmatory puncture as the initial step of any operation is predicated.

The decapsulation of the lungs along a distinct line of cleavage; the return of lung expansibility; hemorrhage and drainage, all constitute features analogous to the steps in the performance of prostatectomy; only the loss of blood being vastly larger in the latter.

In closing we wish here to cite a very recent confirmation of our attitude: In a discussion at the Société de Chirurgie de Paris,⁶ in the early part of this year (1916), on "Extraction of Bullets" lodged in the lung, Duval⁶ took issue in saying that surgeons up to the present time were too timid in regard to surgery of the lung and pleura. The lung may be operated on without special instruments or apparatus according to the ordinary principles of surgery. Total pneumothorax, partial exposure of the pulmonary lobes, freeing them from adhesion on all sides, exposure and delivery of the lobes in order to reach the mediastinum or diaphragm, are simple procedures without particular danger. The lung is a tolerant organ which may be operated on as easily as an intra-abdominal viscus and with the aid of an excellent rib retractor whereby all the view of the interior of the thorax that is necessary is obtained.

For the many courtesies to assist and privileges to independently operate numerous patients, as well as encouragement and advice in the preparation of this paper, my thankful acknowledgments are due to Dr. Lilienthal.

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THE PROGNOSTIC AND THERAPEUTIC SIGNIFICANCE OF SKELETAL METASTASES IN CARCINOMA OF THE BREAST*

BY ISAAC LEVIN, M.D.

OF NEW YORK

CLINICAL PROFESSOR OF CANCER RESEARCH IN THE NEW YORK UNIVERSITY AND BELLEVUE HOSPITAL
MEDICAL COLLEGE; CHIEF OF THE DEPARTMENT OF CANCER RESEARCH OF THE
MONTEFIORE HOME AND HOSPITAL, NEW YORK

(From the Department of Cancer Research of the Montefiore Home and Hospital,
New York)

THE operative procedures for carcinoma of the breast as elaborated by Willy Meyer and Halsted in the United States, Rotter in Germany, and Handley in England, increased considerably the chances for a radical cure of the disease. Indeed, in its early stages, according to the statistics of Halsted, fully 85 per cent. of the cases remain well for the period of three years after the operation. Nevertheless, even to-day the ultimate results obtained with the most radical methods of surgical treatment of carcinoma of the breast are far from being satisfactory. The reason for this lies in the difficulty in having the patients submit to the operation in the early stages of the disease.

It is impossible to form a perfectly correct estimate of the true therapeutic value of the radical amputation of the breast for carcinoma, since in the majority of the publications the authors do not state the percentage of cases which were considered entirely inoperable and therefore were not submitted to any surgical treatment. It is self-evident on the other hand, that the differences in the conceptions of the operability of the cases influence to a great extent the postoperative results. Nevertheless a fairly accurate idea of the results may be formed from an analysis of the recent publications. In the years 1907-1908 there appeared a number of publications with reports of a decade of work with Halsted's and similar methods of radical operations for carcinoma of the breast. Chart I, taken from Halsted's¹ publication, may serve as an example of the results obtained.

CHART I

	Cases	Cured	Per cent.	Cured 3 years	Per cent.
Axilla and neck negative	60	45	75	51	85
Axilla positive negative, neck negative....	110	27	24.5	34	31
Axilla and neck positive.....	40	3	7.5	4	10
Total	210				

* Read at the meeting of the Section on Surgery of the New York Academy of Medicine, November 3, 1916.

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Halsted reports in all on 293 cases. Eighteen cases could not be traced and 65 cases had only palliative operations. The remaining 210 cases are divided into 3 groups. The first group consists of early cases in which there is no involvement of the lymphatic glands. In the second group, there are placed the advanced cases with the involvement of the axillary glands, and in the third group the far advanced cases with the involvement of both the axillary and neck glands.

Of the 60 cases of the first group, 51 cases, or 85 per cent., remained well three years after the operation. It is remarkable to note in this connection that even the cases of the Johns Hopkins Hospital, notwithstanding the active educational propaganda carried out by Bloodgood, only 20 per cent. of all the cases reported were in the first group, or in the early stages of the disease. It is probable that were the cases in which even a palliative operation was refused added to the report, then the percentage of the early cases would have been even smaller.

CHART II

Group	Series	Number of cases operated	Number of cases cured	Per cent.
I	I	14	11	78.5
	II	7	6	84.7
II	I	68	20	29.4
	II	25	8	32
III	I	7	0	0
		5	0	0

Chart II presents a very interesting analysis of 200 cases operated upon by Steinthal.² He divided 126 cases which were followed up in 3 groups, similar to those described by Halsted. Each group is again divided into 2 series. The first series of cases were operated by the old methods, and the second series by the modern radical methods. The analysis of his material shows that while in the first group, or the early cases, the radical operation produced better results than the old operations, the difference in the results in the advanced cases is not so marked. In the third group no advantage was obtained from the radical operation, either by Steinthal or Halsted, though the latter reports that 10 per cent. were cured, while all the cases of Steinthal in this group died, notwithstanding the operation. Thus the more advanced the disease, the smaller is the probability of obtaining permanent results, even from the most radical surgical treatment. In his latest publication Steinthal expresses the opinion that the increase in the percentage of cured cases is not due to the improvement in the operative technic, but to the earlier recognition of the disease.

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The limitations of the surgical treatment of carcinoma of the breast are due to the following reasons: R. R. Greenough, C. C. Simmons and J. D. Barney³ have shown that 52 per cent. of the cases in which the operation fails do not show any local recurrence in the operative field, but only metastases in distant regions. In these cases the removal of the local growth was complete, and the metastases were either formed before the operation, or else a tumor embolus was carried away from the primary tumor in the course of the operation. In either event the extent of the operation could not influence the final result. Thus it is self-evident that in the advanced cases which represent three-quarters of all cases submitted to the operation, the probability of the existence of a metastasis before the operation, and of a consequent failure of even an ideal operative method, is great.

Handley⁴ attempts to prove that embolism has no significance in the formation of metastasis of carcinoma of the breast. According to his conception, metastasis is formed by a process of "lymphatic permeation." The tumor cells grow along the lymphatic vessels until they reach the nearest lymph-glands, and from these glands the cells enter the next lymphatic vessel. This process is continuous, and the appearance of an apparently isolated tumor nodule is due to the fact that a perilymphatic fibrosis destroys the permeated lymphatic vessels which form the lines of communication. The formation of metastases in distant organs Handley ascribes to the proliferation of cancer cells which escape from the subserous lymphatic plexuses into the serous cavities, pleura, or peritoneum. The cells are then distributed through these cavities under the influence of gravity and of visceral movements and implanted on the serous surface of the viscera. As a proof of this contention he cites the fact that parts of the skeleton distal to the elbow and knee-joints usually escape cancerous invasion. Now, in the first place Case VII shows skeletal metastases distal to the elbow (Fig. 9). Moreover, it is impossible to conceive even on the basis of Handley's theory how a distant metastasis without a local recurrence after an operation occurs, unless the transport of the cancer took place before or during the operation.

CHART III

Years after operation patients are alive	Number of cases	Per cent.
4	123	43.20
8	48	16.9
10	35	12.32
15	23	8.1
20	7	2.46
	328	

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Similar conclusions must be drawn from the analysis of Chart III obtained from the report of a French surgeon, Heurtaux.⁵ He operated during the 30 years previous to the date of his report on 341 cases. The operation consisted in the removal of the breast and the axillary lymphatic glands without the disturbance of the pectoral muscles. Though his operation is not as thoroughly radical as Halsted's, 43.3 per cent. of the 284 cases which could be traced remained well 4 years after the operation. This remarkable result may be partly due to a special selection of cases for the operation, but what makes the investigation of Heurtaux of the greatest value is the fact that he watched and controlled his patients for 30 years. He was thus enabled to estimate the ultimate results at long intervals after the operation, and as Chart III shows twenty years after the operation only 2.46 per cent. of the cases remained alive and free from the disease. While there are many reports in the literature of isolated cases of late recurrence of carcinoma of the breast, Heurtaux is the only investigator who showed the remarkable frequency with which these late recurrences take place.

Thus the analysis of the cases of Steinthal and Heurtaux demonstrate clearly two facts in relation to the true value of the radical amputation of the breast for carcinoma. In the first place in advanced cases, the result of the radical operation is not better than the results of simpler surgical procedures, furthermore in the greater part of the cases which are apparently cured 3, 4 and 5 years after the operation, the disease recurs at a later date. This latter phenomenon is due in over half of the cases, not to a local recurrence of the disease, but to metastases in distant regions.

Now, carcinoma of the breast metastasizes most frequently in the lungs, bones and the liver. The involvement of the latter organ is probably due in accordance with the theory of Handley to a lymphatic permeation, *i.e.*, a local outgrowth from a neighboring region. Metastasis in the liver occurs usually late in the course of the disease and is secondary to an extensive local recurrence and metastases in the lungs or bones. The formation of metastases in the latter organs is undoubtedly due, as the writer stated in several publications,⁶ to an embolic transport of cancer tissue before or during an operation and may take place without a local recurrence. The development and the course of metastases in the lungs is usually quite rapid and is accompanied by early clinical symptoms indicative of the condition. The metastases in the bone are apparently the most frequent cause of the late recurrence in carcinoma of the breast. The condition may con-

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tinue for a long time without causing any symptoms, and when at an autopsy metastases are found, both in the bones and in many other organs, it is highly probable that the latter appeared subsequently to the formation of the skeletal metastases. The fact that E. Kaufman⁷ found skeletal metastases in the bones in 52.3 per cent. of the cases that died of carcinoma of the breast is a true indication of the frequency of the condition.

PRE-OPERATIVE DIAGNOSIS OF SKELETAL METASTASES

A radical operation for carcinoma implies an attempt at complete eradication of all cancer tissue within the organism. While a radical amputation of the breast is not accompanied by a high postoperative mortality, it is nevertheless a severe operative procedure. It is usually followed by a prolonged after-treatment, and frequently by disability, pain and swelling of the arm. Moreover, the thorough clearing out of the axilla may be followed by a dissemination of cancer tissue into distant organs and subsequent formation of metastases. In view of all this, it is imperative to ascertain before the operation whether there are any metastases present in any distant region of the organism of the patient.

Metastases in the lungs and in the liver as a rule produce clinical symptoms and are easy to recognize. Skeletal metastases, on the other hand, as stated above, may continue for a long time without causing any symptoms whatever. The frequent reports of pathological fracture occurring in patients who apparently enjoyed previously perfect health, and in whom only the accident revealed the presence of carcinoma, bear out this assertion.

The mechanism of the development and growth of skeletal metastases, as will be shown later, shows the reason for the late development of the clinical symptoms, but in any event, it is certain that a case of carcinoma of the breast with the involvement even only of the axillary glands may harbor metastases in the bones which do not manifest themselves in any way. The only method by the aid of which many of such metastases may be detected is the röntgenographic examination of the skeleton.

The röntgenogram usually reveals a central focus of bone destruction which is evidently replaced by carcinoma tissue. It must be admitted that a negative finding is not conclusive, since the tumor nodule in the bone may be too small and has not destroyed as yet a sufficient amount of the bone tissue to present a shadow on the plate, but a positive result makes the diagnosis of the condition certain. In

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view of the importance of the subject it is remarkable how little attention is being paid to this method of diagnosis of skeletal metastasis.

As stated above metastases, usually in the bones, may be present at the time of the operation in 52 per cent. of the advanced cases of carcinoma of the breast, even with involvement only of the axillary glands. It is therefore imperative that in every advanced case, or better still, in every case of carcinoma of the breast, a röntgenographic examination be made of the skeleton before the operation. If it is too expensive or difficult to explore the whole skeleton, then those parts should be examined in which metastases most frequently occur, namely the spine and the femurs.

REPORT OF CASES

At the service of the writer in the Montefiore Hospital, the röntgenographic examination of the skeleton of all cases of carcinoma of the breast is a routine procedure. During the past three years the writer observed 10 cases of carcinoma of the breast complicated by skeletal metastases. The clinical, röntgenographic and pathological study of these cases presented several points of interest in connection with the questions of prognosis and therapy of carcinoma of the breast. The following is a brief résumé of the clinical histories of the cases:

CASE I.—Mrs. B., aged thirty-nine, an advanced carcinoma of the right breast with involvement of the axillary and the supra-clavicular glands. A radical amputation of the breast was done on November 17, 1913. Pain in the hip-joints developed two months after the operation; six months after the operation the patient became bedridden, developed perfect clinical evidence of metastases in both femurs, and died nine months after the operation. No autopsy could be obtained.

CASE II.—Mrs. G., aged forty-three, was admitted to the Montefiore Hospital on December 3, 1913. Two years previous to the admission to the hospital the patient underwent a radical amputation of the right breast for carcinoma. The patient died on December 31, 1913. Autopsy showed metastases of carcinoma in the viscera and in the sternum. The latter served for pathological study.

CASE III.—Mrs. B. H., aged forty-one, admitted to the Montefiore Hospital on January 21, 1914, with an inoperable carcinoma of the right breast, painful spine and inability to walk. Clinical and Röntgen examination showed metastases in the eighth, ninth and tenth ribs, and in both femurs; the patient died on May 20, 1914. Autopsy showed carcinoma of the breast and metastases in the axillary lymph-glands, pleura, both trochanters and the

eighth, ninth and tenth ribs. A microscopic study was done of the ribs and trochanters.

CASE IV.—Mrs. T. S., aged thirty-nine, admitted to the hospital May 14, 1914, with a recurrence of a carcinoma of the right breast which was amputated about six months previously. Clinical and röntgenographic examinations revealed metastases in the right femur. Patient died June 17, 1915. Autopsy showed medullary carcinoma of the breast, metastases in the axillary, cervical, mediastinal, bronchial and retroperitoneal lymph-glands and in the head of the right femur. The metastasis in the femur served for pathological study.

CASE V.—Miss R. S., aged forty-two. A radical amputation of the right breast was done in August, 1915, for carcinoma with involvement of axillary and supraclavicular lymph-glands. Four months later there developed a kyphosis, a swelling at the regions of both trochanters and inability to walk; two months later the patient began to complain of severe headaches, became delirious, then developed a right hemiplegia which was followed by death two days later. No autopsy could be obtained, but there was undoubted clinical evidence of metastasis in the spine.

CASE VI.—Mrs. R. E., aged fifty-six. A radical amputation of the left breast for carcinoma was done in the Brooklyn Jewish Hospital in August, 1913. Three weeks after the operation there set a pain in the right thigh, later the left thigh became involved. The patient was admitted to the Montefiore Home and Hospital on November 10, 1914. One month after admission she sustained a fracture of the right femur. The patient died on January 1, 1916. Autopsy showed metastases in the liver, ribs and both femurs. This case showed a very slow progress of the skeletal metastases; pain in the thighs developed three weeks after the operation, consequently the metastases were already present during the operation, since the cancer nodule in the bone must obtain a certain size before the pains appear and still the patient lived two and a half years after the operation.

The analysis of the röntgenograms gives very interesting indications of the pathological development of the process, the plates taken immediately after the fracture occurred show the fracture in the right femur (Fig. 1) and destruction of bone, *i.e.*, tumor masses further down the shaft (Fig. 2), and reveal nothing abnormal in the left femur (Fig. 3); röntgenograms taken ten months later show in the right femur (Fig. 4) bridges of newly-formed bone in the area of the old fracture. Indeed the latter appears to be firmly healed, a fact which was noted clinically. Below the old fracture there has taken place a new fracture. The left femur (Fig. 5) shows now distinct areas of metastases. It is

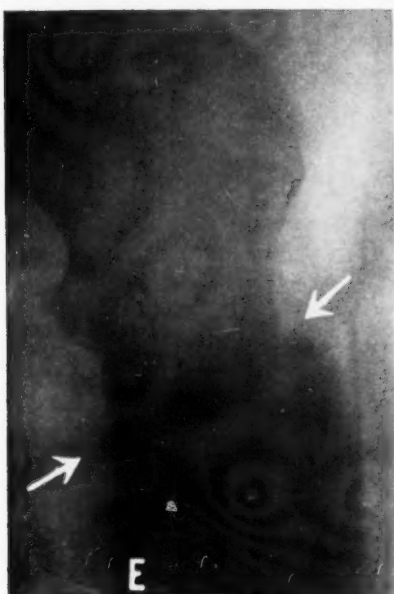


FIG. 1.—Case VI. Röntgenogram of the neck of the right femur. The arrows show the line of fracture.

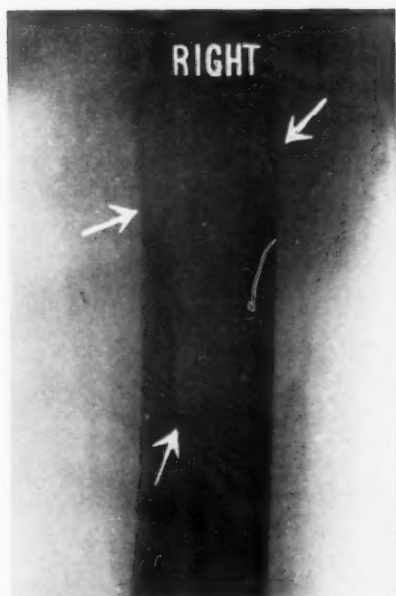


FIG. 2.—Case VI. Röntgenogram of the shaft of the right femur. The arrows show the metastatic tumors.



FIG. 3.—Case VI. Röntgenogram of the neck of the left femur. It shows no abnormality.

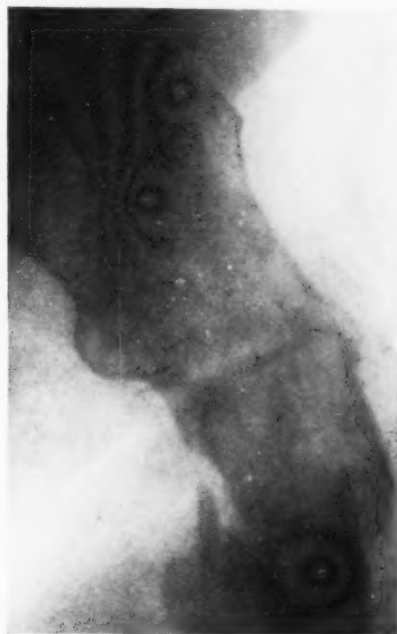


FIG. 4.—Case VI. Röntgenogram of the neck of the right femur, taken ten months later. Shows double fracture.

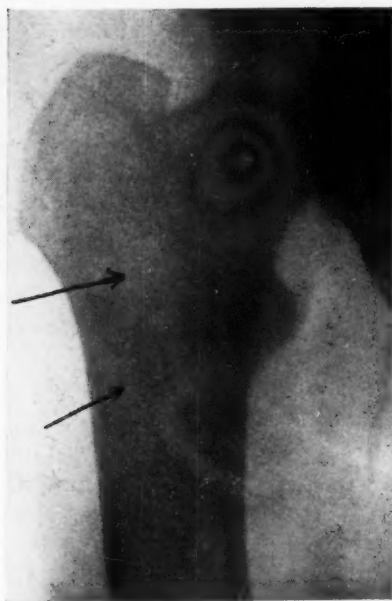


FIG. 5.—Case VI. Röntgenogram of the neck of the left femur, taken ten months later. The arrows show the light spots of bone absorption—metastases.



FIG. 6.—Case VI. Sawed open surface of the left femur. Shows metastases and hemorrhages.



FIG. 7.—Case VII. Röntgenogram of femur and pelvic bones. Shows irregular bone destruction.

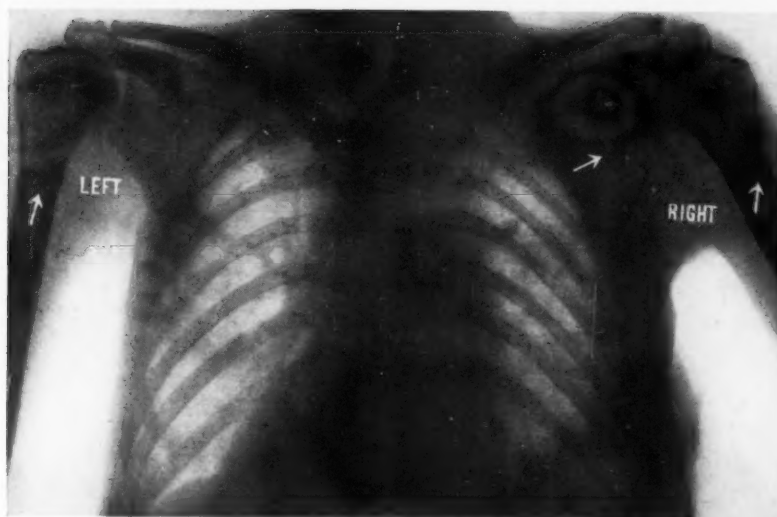


FIG. 8.—Case VII. Röntgenogram of chest. Shows absorption of bone.



FIG. 9.—Case VII. Röntgenogram of humerus, radius and ulna. Shows extensive irregular bone destruction.



FIG. 10.—Case VII. Röntgenogram of skull. The arrow shows bone absorption.



FIG. 11.—Case VIII. Röntgenogram of spine. Shows absorption of bone of the eleventh and twelfth dorsal vertebrae.



FIG. 12.—Case VIII. Röntgenogram of the neck of femur. The arrow shows bone absorption in the upper portion of the neck.



FIG. 13.—Case IX. Röntgenogram of the left half of the chest. Shows destruction of bone in the left clavicle.



FIG. 14.—Case X. Röntgenogram of the spine. Shows bone destruction in the centre and new bone formation in the periphery (two bridges) in the contiguous portions of the second and third lumbar vertebrae.



FIG. 15.—Case X. Röntgenogram of the spine taken one year later. Shows some increase in the new bone formation.



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very striking that the sawed open surface of the left femur (Fig. 6) shows the metastases practically in the same positions as on the röntgenogram.

CASE VII.—Mrs. A. B., aged forty-five, previous illness began a year ago with pain in the left hand, radiating down from the shoulder. She consulted a physician who called her attention to little lumps in the left breast: she went to Mt. Sinai Hospital where her left breast was amputated; after leaving the hospital the patient experienced great pains in various regions of the body, chest, legs, back, etc. The pain grew gradually worse, until six months later she went to Gouverneur Hospital, where she stayed fourteen days. The patient became gradually weaker, paler, and complained of headaches, pains in various regions of body, loss of weight and impairment of vision. On October 1, 1915, she was admitted to the Montefiore Home and Hospital. On admission röntgenograms of nearly the whole skeleton of the patient were taken with the following results:

Hips: Marked irregular bone destruction of the upper part of both femurs and the pelvic bones (Fig. 7).

Shoulders: Advanced irregular bone absorption of all the bones entering into the formation of the shoulder-joints.

Ribs: The posterior parts of almost all the ribs, especially on the left side, show a great number of spots of bone destruction. Fig. 8 shows the condition of both shoulders and the ribs and Fig. 9 the same in radius and ulna.

Skull: All the bones of the skull show a great amount of irregular bone destruction of both tabulæ (Fig. 10).

All the abnormalities in the skeleton stated above were due to multiple metastases of carcinoma in the bones.

December 30, 1915: The palpation of the skull shows a protuberance over the left temporal region, consisting of a soft diffuse mass, about 2 inches in diameter (a massive bone metastasis).

Palpation of the left side of the chest wall is painful. Second, third and fourth ribs feel rough and nodular. The left knee-joint is swollen and painful; an enlargement is apparent at the head of the tibia.

January 13, 1916: A swelling has developed in the middle of the right clavicle, which is soft on palpation, and indicates a complete destruction of the bone in this section of the metastatic area.

January 19, 1916: Patient's speech is not clear, slow and confused; complains more of pain than heretofore, and in addition to the already found swellings, she developed a swelling over the right Poupart's ligament which is soft, doughy and easily compressible, but not tender.

January 22, 1916: Patient was unconscious for the last two days; the patient died on January 22, 1916. An autopsy could not be obtained, but the clinical history, which was given here at greater detail than in the other cases, as well as the röntgenograms prove conclusively the presence of an extensive skeletal carcinoma. The case presents the most extensive involvement of the skeleton of any described in the literature and shows that skeletal metastases may develop below the elbow. This last fact is important since, as stated above, Handley bases his pathological conception and operative technic to a great extent on the fact that skeletal metastasis in carcinoma of the breast does not develop below the elbow or knee-joint.

CASE VIII.—Mrs. R. R., aged forty-three, admitted to the Montefiore Home and Hospital January 16, 1916. Present illness began May, 1915, when the patient noticed a very small lump, the size of an orange seed, underneath the skin of the left breast. In August the breast was amputated at Beth Israel Hospital. In October the patient began to complain of pain in lower extremities and back.

A röntgenogram taken on January 20, 1916, showed great absorption of bone of the eleventh and twelfth dorsal vertebrae (Fig. 11). The entire lumbar spine had a worm-eaten appearance: the upper portion of the neck of the right femur (Fig. 12) shows multiple areas of bone absorption. Patient died on February 13, 1916. The autopsy performed by Dr. B. S. Kline showed carcinoma of breast with recurrence in wound following removal. Metastases to the regional lymph-glands, liver, pancreas, lung, right femur and in the eleventh and twelfth dorsal vertebrae. The metastases in the bones were studied microscopically.

CASE IX.—Mrs. B., aged fifty-four. The patient underwent a radical amputation of the left breast for carcinoma in 1911. In the summer of 1914 there developed a swelling measuring 2 inches long, $\frac{3}{4}$ inch wide, and 1 inch high, adherent to the left clavicle. The röntgenogram (Fig. 13) shows partial destruction of the bone and consequently a metastasis in the left clavicle. The case was referred to the writer (by Dr. Bodenheimer) in August, 1914. Under a combined radium and Röntgen treatment the swelling disappeared. The case was reported in September, 1915.⁸ Now nearly two and a half years after beginning of the treatment, the patient is clinically well and does not show any recurrence of carcinoma anywhere.

CASE X.—Mrs. D. L., aged forty. The patient had a radical operation of the right breast for carcinoma done in May, 1915. On leaving the hospital the patient felt perfectly well for two

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weeks, when she began to experience pain for the first time. This pain was situated in the region of the lower lumbar vertebræ, the patient claiming that the pain was similar to that felt during child-birth. The above has persisted ever since. With the onset of pain there developed loss of weight and general weakness. The pain was very severe and the patient has been confined to bed. The patient was admitted to the Montefiore Home and Hospital on November 10, 1915. A röntgenogram of the spine taken on admission (Fig. 14) showed a slight destruction of the contiguous portions of the second and third lumbar vertebræ with some bone condensation and very marked new bone formation in form of bridge formation on both sides.

The patient received Röntgen treatment both over the chest and the region of the second and third lumbar vertebræ. At present, one year after admission, the patient left the hospital greatly improved, able to walk around and work. A later röntgenogram (Fig. 15) shows apparently some increase in the bone formation in the region of the second and third vertebræ.

CLINICAL AND PATHOLOGICAL CONSIDERATIONS

The clinical and röntgenologic study of the cases shows that the skeletal metastases undoubtedly were present in all of them at the time of the operation. Pain in the different parts of the skeleton either appeared before or very soon after the operation. The röntgenograms taken upon the admission to the hospital showed usually an extensive involvement of the bone, and the identical condition was found at the autopsy. All this shows that the metastases were of long standing. Statistical investigations as stated above indicate that skeletal metastases of carcinoma may be very slow in their development. It may take years before clinical manifestations of any kind present themselves. The pathological studies of the writer bear out and elucidate the reasons for this phenomenon.

The metastasis of carcinoma in the bone begins its development within the marrow, and when the group of cancer cells are small, the surrounding bone-marrow appears quite normal. Figs. 16 and 17 present microphotographs of two such small cancer nodules within a bone-marrow space. Von Recklinghausen claims that the development of the metastasis is preceded by a hyperæmia and hæmorrhage due to the obstruction of the capillaries by endovascular tumor emboli. In the specimens studied by the writer hæmorrhages and hyperæmia were noted frequently around large tumor masses, in the femur, for instance (Fig. 6), but not around minute metastatic nodules. In

the latter instances as stated above no morphological abnormality could be found in the bone-marrow.

As the tumor nodule increases in size it approaches and invades the compact osseous tissue or the compact osseous partitions of the cancellated bone, and then there begin to appear the characteristic changes in the bone tissue. It is generally accepted that there are two classes of skeletal metastases of carcinoma: *osteoplastic*, in which there takes place a great deal of new bone formation around the metastatic tumor, and *osteomalacic*, in which the change of the normal tissue surrounding the metastasis consists in extensive destruction of the compact bone. These two distinct conditions can be easily differentiated on the gross inspection of skeletal metastases. However, the microscopic study of the cases of the present investigation by the writer has shown that both conditions are usually present side by side, and only in one case *osteosclerosis*, or new bone formation, predominates, while in another *osteoporosis*, or the destruction of the old bone, is mainly evident. Figs. 18 and 19 show an extensive new bone formation, while Fig. 19 presents only destruction of the old bone, and both specimens were obtained from different regions of the same metastatic tumor.

The mechanism of the bone destruction in metastases of carcinoma differs from the one observed in inflammatory osteoporosis. Von Recklinghausen⁹ first made the observation that the large polynuclear osteoclasts which destroy the bone in osteoporosis are very seldom found in the lacunæ of the bone surrounding a growing metastasis of carcinoma. This fact was confirmed by most of the subsequent investigators. In view of the absence of the large osteoclasts, Von Recklinghausen presumed that there takes place in the bone a softening by the removal of the inorganic salts, and a subsequent absorption without the aid of any cells, a condition similar to the one found in osteomalacia. Apolant,¹⁰ Erbslöh,¹¹ Askanazy,¹² are also of the opinion that osteoporosis in skeletal carcinoma may take place without the aid of special cells. On the other hand, Wolff¹³ and Goetsch¹⁴ believe the cancer cells act as osteoclasts and destroy the compact bone, and Axhausen¹⁵ maintains that the small elongated mononuclear connective-tissue cells, frequently found close to the walls of the lacunæ, are special osteoclasts derived from the cancer stroma. In the specimens studied by the writer both carcinoma cells, as well as the small connective-tissue stroma cells, are found in close immediate apposition to the walls of the lacunæ. The carcinoma cells were so frequently the only cellular elements within the lacunæ of the bone that there



FIG. 16.—Microphotograph of a bone-marrow space. The arrow shows a small island of cancer cells. (Low magnification.)

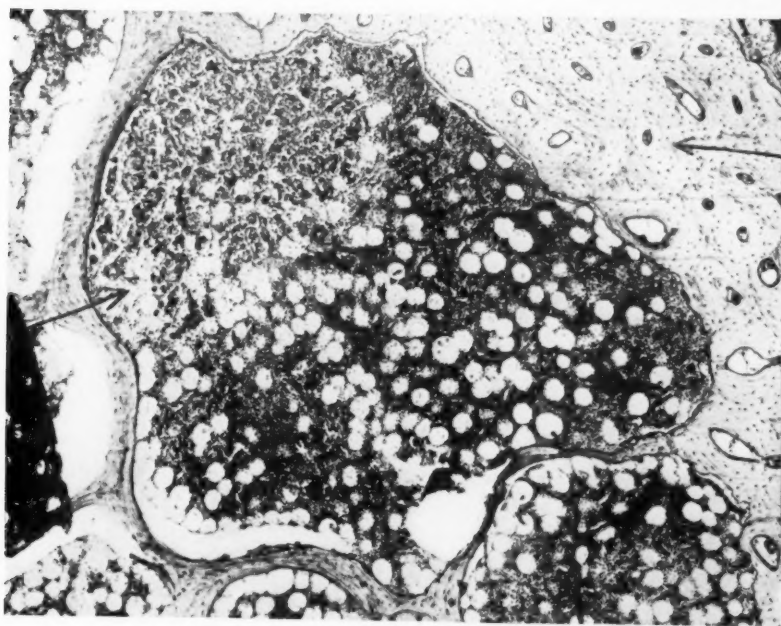


FIG. 17.—Microphotograph of a bone-marrow space with a small nodule of carcinoma (larger than in Fig. 16). The arrow *a* shows the carcinoma. The arrow *b* shows compact bone. (Low magnification.)

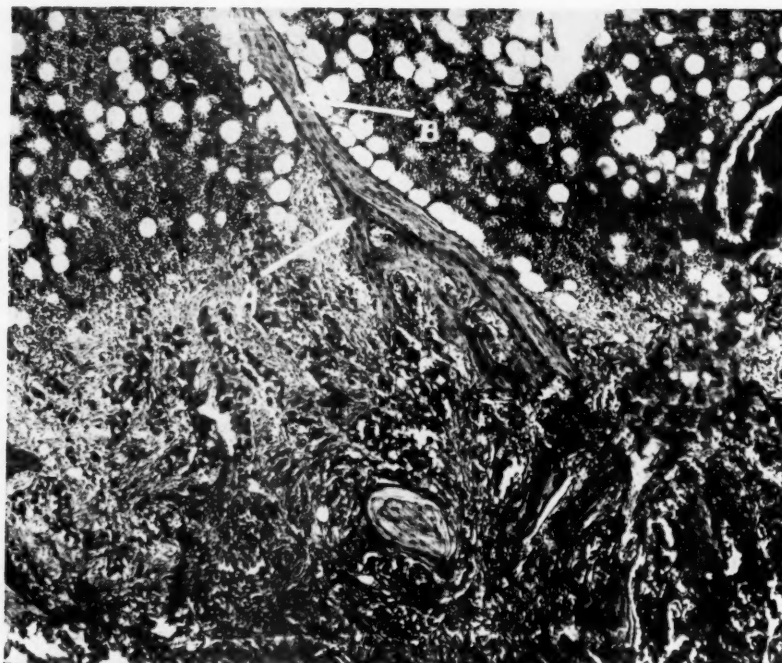


FIG. 18.—Microphotograph shows a great deal of new bone formation in the vicinity of an old bridge of compact bone tissue. *B* shows old bone; *A*, new bone.

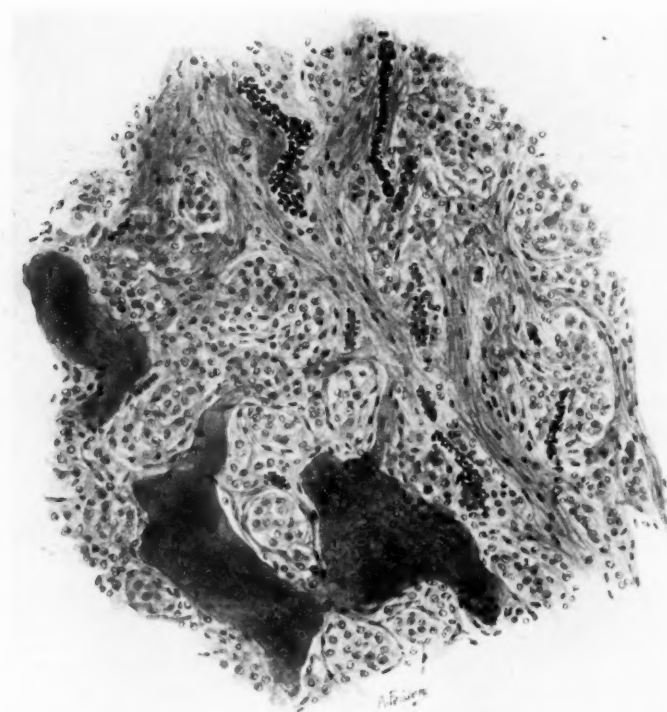


FIG. 19.—From a microscopic section of a skeletal metastasis stained with Van Gieson. Shows collagen fibrils emerging from the old bone and uniting with other fibrils.

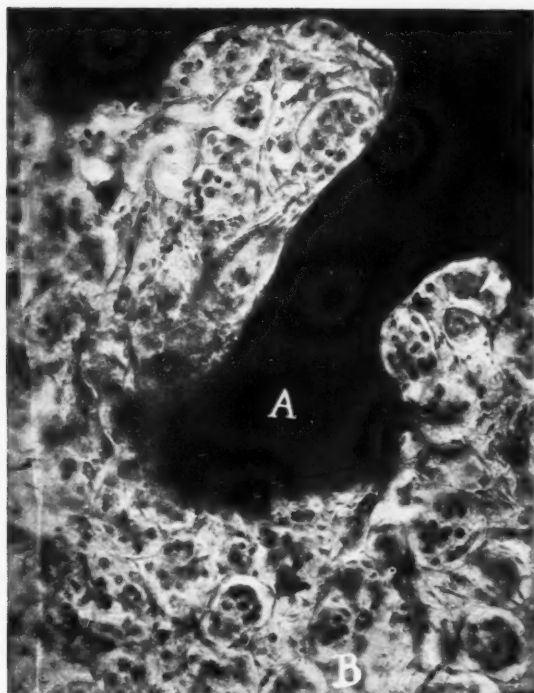


FIG. 20.—Microphotograph, two bone lacunæ filled with carcinoma cells. A, shows bone; B, carcinoma. (Low magnification.)



FIG. 21.—Röntgenogram of case of sarcoma of mandible taken before treatment. Shows tumor with two radium tubes *in situ*.

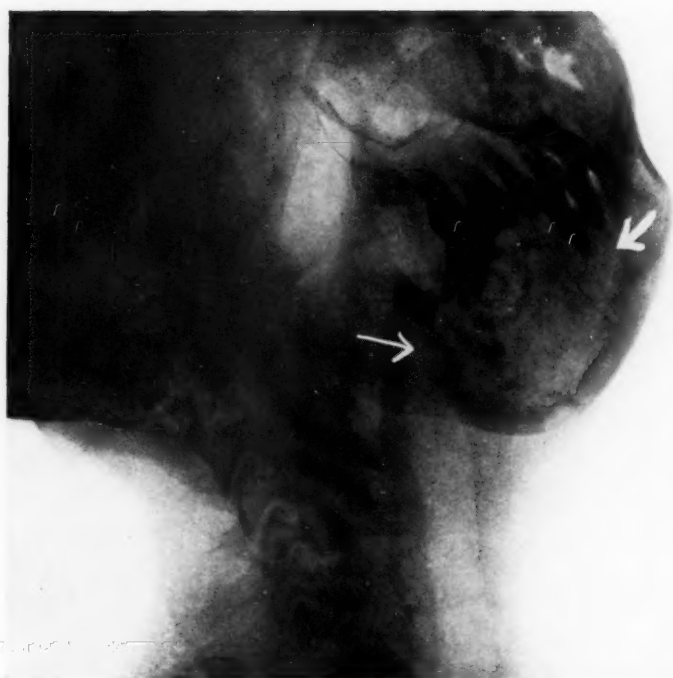


FIG. 22.—Röntgenogram of case of sarcoma of mandible taken after treatment. The arrows show the new bone formation.

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cannot be any doubt that carcinoma cells act as direct osteoclasts. Fig. 20 shows lacunæ filled with carcinoma cells. The impression gained by the writer is that the small stroma cells only subsequently enter between the bone and the carcinoma cells. But even if the possibility be admitted that occasionally the stroma cells may act as osteoclasts, it seems quite apparent that the tumor itself, by the aid of its formed elements, first destroys the bone and then grows by occupying the produced space.

While the mechanism of osteoporosis in skeletal metastasis as stated above is at least similar to the mechanism of the destruction of any normal tissue surrounding a growing malignant tumor, the osteosclerosis, or the extensive formation of new bone tissue, is characteristic of skeletal metastases.

Von Recklinghausen claims that this extensive new bone formation is due to the hyperæmia described by him and mentioned above. Courvoisier¹⁶ and Kaufman⁷ maintain that a metastasis in the bone is always surrounded by a zone of inflammation, and this latter caused the osteosclerosis. Askanazy¹² thinks that the metastasis at first produces an osteoporosis, which is followed by a bone necrosis, and the necrotic bone acting as a foreign body caused a new bone formation. Wolf,¹³ Courvoisier,¹⁶ and Kaufman,⁷ are of the opinion that carcinoma cells may act as osteoclasts and form new bone tissue. Fig. 19 presents a picture very frequently observed by the writer. It shows collagen fibrils developing in abundance from the old bone. These fibrils gradually unite in thick bundles and subsequently form new bone tissue. The latter is clearly formed from the constituent parts of the old bone tissue. On the other hand, as stated above, the writer did not observe any hyperæmia, inflammation or any other abnormality of the bone-marrow at the beginning of the development of the metastases. Neither did the writer find any necrosis of the bone in any of the specimens examined. It must be concluded in agreement with Axhausen's¹⁵ conception that some unknown chemical irritant emanating from the carcinoma cells acts on the old bone tissue and stimulates its proliferation.

Thus there constantly and side by side take place in skeletal metastasis two processes. On one hand the tumor cells destroy the normal bone tissue and occupy its place, and on the other hand the remaining bone tissue proliferates and creates new bone. The latter is quite probably an attempt at self-defense on the part of the organism. The newly-formed bone tissue may compress and destroy the cancer cells, or at least inhibit their proliferation. Case VI shows such a condition. There took place a pathological fracture in the right femur, which

subsequently became firm and seemed clinically healed (Fig. 4), while later a second fracture took place below the first. Here apparently nature succeeded in healing one metastatic focus in the bone, while in another place the tumor grew unchecked. Such temporary healing of a pathological fracture within a skeletal metastasis was described in several instances.

Thus the microscopic study of skeletal metastasis gives a clear evidence of the interaction which always takes place between the normal organ tissue and the cancer cells in the beginning of the development of a metastatic tumor from a transported cancer embolus. Upon the result of such an interaction depends the success or failure of the formation of metastasis. In the bone the conditions are evidently more favorable for at least temporary suppression of the proliferation of the cancer cells by the newly-forming bone tissue, and therefore skeletal metastases develop only slowly and appear late.

THE PROGNOSTIC SIGNIFICANCE OF SKELETAL METASTASES

The radical operation for a malignant tumor means a complete eradication of all tumor tissue from the organism. It is patent that a radical operation in this sense of the word is impossible as long as a skeletal metastasis was diagnosed before the operation. Furthermore, Heurtaux has shown that ten years after a breast amputation only 12.32 per cent. remain free of the disease and twenty years after the operation only 2.46 per cent. remain free. It would then seem that in the overwhelming majority of all the cases of carcinoma of the breast the best surgical methods of treatment do not completely eradicate the disease, but only prolong life. But on the basis of the latter interpretation of the therapeutic results in carcinoma of the breast skeletal metastases give a better prognosis than metastasis in other organs, since they are much slower in their development and may therefore be more readily controlled.

RADIUM AND RÖNTGENOTHERAPY OF SKELETAL METASTASES

As stated above, the radical amputation of the breast in the presence of skeletal metastases cannot cure completely the disease. On the other hand, the operation if correctly performed may prolong the life of the patient, since the removal of the primary tumor diminishes the possibility of subsequent formation of metastases in other organs than the bone. But the operation, while aiming at a complete as possible removal of the main mass of the tumor, does not need to be entirely radical. It is more important not to handle and massage the tumor too energetically during the operation and thereby transport cancer cells

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into the circulation, than to remove every vestige of it. The writer⁸ has shown in a previous publication that small islands of tumor cells can be destroyed by radium and Röntgen rays, even at a great distance from the skin, and it should therefore be easy to eradicate by the aid of the radiations small remnants of the tumor located in the axilla, or over the chest wall. The diathermic coagulation of tissue which the writer¹⁷ discussed in previous publications, and which destroys the carcinoma cells *in situ* without opening the blood and lymph channels, may become the operative methods of choice for such incomplete operations when the correct technic is developed.

Thus the correct treatment of carcinoma of the breast, complicated with skeletal metastases, consists in the operative removal of the gross tumor mass, combined with radium and Röntgen therapy. The radiations in a postoperative case of carcinoma of the breast should not be given only over the operative field and over the chest wall, which is the procedure generally adopted to-day, but should include, if not the whole skeleton, at least the spine and the heads of both femurs. Moreover, this combination of surgery and radiotherapy should be the method of choice in all advanced cases of carcinoma of the breast, even when there is as yet no evidence of skeletal metastases.

The writer has shown¹⁸ that one of the important effects of radium and röntgenotherapy consists in the formation of an extensive connective-tissue stroma, surrounding and compressing the tumor cells. In skeletal metastases this stroma, as the pathological study reported above shows, is transformed into bone. It is thus self-evident *a priori* that the radiotherapy must enhance the results of the attempts at cure produced by nature.

In a case reported by the writer in 1915, though not a metastatic carcinoma, but a primary sarcoma of the bone (right mandible), new bone formed under the influence of radium and Röntgen therapy. Eight weeks after the beginning of the treatment, the tumor had completely disappeared, and instead there was present a large cavity lined by a shell of bone. Fig. 20 shows a röntgenogram taken immediately at the beginning of the treatment, with the radium tubes *in situ*. There is seen a nearly complete loss of bone around the tumor. Fig. 21, a röntgenogram taken after treatment, shows that the swelling is surrounded by a great deal of new-bone formation. The Cases IX and X of the present report clearly show that radium and röntgenotherapy may cure clinically skeletal metastases of carcinoma. Case IX is clinically well and shows no recurrence in other regions of the body for two and a half years.

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Case X is now clinically well one year after admission to the hospital, while a year ago it presented the picture of a most hopeless condition, ever met even among cases of inoperable carcinoma. Though it cannot be stated as yet for how long the patient's life will be prolonged, the achievement in this case is certainly sufficient to encourage further attempts at the same method of treatment.

It would lead too far to go here into details of the technic of radiotherapy, but one point must be considered, the treatment must be continued at stated intervals for a long time, and if it is interrupted too soon, the metastatic tumor may become active again, destroy a large area of bone and then the subsequent radiations will be of no avail.

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THE SIGNIFICANCE OF THE PATULOUS APPENDIX

By J. W. SQUIRES, M.D.

OF CHARLOTTE, N. C.

RÖNTGENOLOGIST AT THE CHARLOTTE SANATORIUM AND CROWELL UROLOGICAL CLINIC

THE patulous appendix is grossly classified into two types, viz.: functionating and non-functionating. It is generally conceded that the non-functionating type is pathological. The significance of the functionating type, however, is not so easily determined and there is a great diversity of opinion as to whether or not it produces symptoms.

Cohen¹ says that the cæcal contents normally pass into the appendix, and the probable reason that the appendix is not visualized is that it fills and empties between observations. However, if this is true, with our present technic, which includes the röntgenographic and fluoroscopic examination, it would be very easy to visualize the normal appendix in every case. Since this cannot be done, we are justified in saying that the cæcal contents do not normally pass into the lumen of the appendix.

Case² says the essential point to determine is, not whether the appendix fills, but whether it empties. A poorly drained appendix is a dangerous one. The writer agrees with this statement only in part. There is no doubt that the patulous appendix with stasis is pathological and should be removed, but this is a gross classification since the patulous appendix produces symptoms before stasis occurs. If the symptoms become marked, it may be necessary to operate, even though there is no stasis.

It is claimed that by firm pressure downward over the cæcum the appendix can be forced to fill, but I do not consider an appendix filled in this way pathological, as it has been filled artificially. Sufficient outside pressure exerted in the proper direction will overcome the mechanism that guards the appendiceal orifice and cause it to give way, producing a temporary appendiceal incompetency.

Clinically, with a negative history of colic, no leucocytosis or local signs it would be impossible to attach any blame to the appendix. Yet, röntgenographically, a finding of marked pylorospasm, hyperperistalsis of the stomach, and a patulous appendix, combined with a history of chronic gastro-intestinal disturbance and hyperacidity, the weight of the evidence would be sufficient to place the blame on the appendix.

So it is observed that the Röntgen ray signs are very dependable, and if we wish to differentiate vague gastro-intestinal symptoms it is necessary to resort to the X-ray.

The Röntgen ray signs should be given careful consideration since the sequelæ to a long-standing patulous appendix are many. There is always a possibility of gastric or duodenal ulcer developing, since the reflex disturbances of the stomach, namely, hyperperistalsis, spasm of the pylorus and duodenum, and the resulting hyperacidity, all tend to create a favorable condition for the developing of ulcer. Also if there occurs a chronic infection of the appendiceal mucosa there is a possibility of secondary infection of the gall-bladder, resulting in a chronic cholecystitis. Lastly, there are invariably established numerous reflex paths which, even though the appendix has been removed, often require considerable patience and skill to overcome. It is also true that fecal material lying in the lumen of the appendix is liable to harden and produce ulceration of the mucosa and a discharge of pus into the cæcum. If the pus drains out readily there will be no leucocytosis or local symptoms. This fact explains why, in many instances, the local signs and blood picture are negative, even though there is infection of the appendiceal mucosa. However, as a rule, in these cases the reflex phenomena are profuse. In one case of patulous appendix the only complaint was frequent attacks of colic. At operation no inflammation or anything distinctly pathological of this appendix could be observed. But on opening the appendix it was found filled with hook-worm. This explained the colicky attacks. In a case of recurring attacks of amœbic dysentery the removal of the patulous appendix was followed by a complete disappearance of the infection.³ The appendix, in this case, probably acted as a focus from which amœbæ escaped from time to time, producing a recurrence of symptoms.

From the Röntgen ray standpoint the life cycle of a patulous appendix is divided into three stages:

First, hyperperistalsis of the appendix with no stasis.

Second, partial failure of peristalsis of the appendix with partial stasis.

Third, complete or almost complete failure of peristalsis of the appendix with complete or almost complete stasis.

The duration of the stages is variable. The first stage may last during the entire lifetime of the patient and produce no signs except the vague symptoms that are mentioned in the text. Or it may go into the other stages at any time and produce marked symptoms. The passage of the first into the other stages occurs by three different

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routes, the first two being mechanical and the third functional, and are as follows: First, suddenly by an acute obstruction in the lumen of the appendix due to hardened fecal material. This complication would immediately usher the appendix from the first stage into the third. Second, gradually, this being effected by infiltration, thickening and contraction of the walls of the appendix, or by means of kinks and adhesions, all of which would produce stasis. Third, or the functional route, is also gradual, and is characterized by a wide lumen and scarcely no peristalsis. In this instance, it seems that the lapse into the third stage is due entirely to an almost flat failure of peristalsis, there being no acute obstruction, kinks or narrowing of the lumen to explain the stasis.

First, the stage of hyperperistalsis of the appendix with no stasis. The röntgenographic evidence of this stage is present in both the stomach and ileocæcal region. In the stomach there is observed hyperperistalsis and marked spasm of pylorus and duodenum. In the ileocæcal region the evidence is the open appendix with no stasis. During this stage the röntgenographic finding is a marked frequency and great force of the peristaltic waves of the appendix. It is also observed that the appendix moves freely, assuming various shapes and positions in its efforts to empty. This unusual activity, I believe, is explained by the entrance of fecal material into the appendix, which acts as a foreign element and causes an abnormal stimulation of the peristalsis, and if it is assumed that the appendix has a parasympathetic innervation the hyperperistalsis could be explained by an abnormal stimulation of these nerves.

The clinical symptoms during the first stage may be either mild or severe and are almost entirely reflex. It is very seldom that the slightest local tenderness can be detected. The gastric symptoms, however, are predominant. These are discomfort, or even tenderness over the pyloric and duodenal area, eructation of gas, and flatulence. During this stage, as long as the gastric symptoms are predominant, there is a hyperacidity of the stomach. During the other two stages the acidity is a variable factor, being normal, hypo- or hyperacid. On account of the constant stimulation from the leaking appendix it is observed that during this stage the reflex path to the stomach becomes so firmly established that a train of gastric symptoms results that is out of all proportion to the pathology of the appendix.

Second, the stage of partial failure of peristalsis of the appendix with partial stasis. This is the stage of beginning failure of compensatory hyperperistalsis and, clinically, we have present, in addition to the

gastric symptoms, occasional slight attacks of colic and local tenderness. It is during this stage that we first begin to think of a possibility of an abnormal appendix, although there is no leucocytosis or tenderness over the appendix, except possibly during the slight colicky attacks. The colic is a warning that there is now a beginning of more marked pathological changes. The appendix is not draining so well and the patient feels considerable discomfort until the appendix succeeds in emptying itself. There are now possibly concretions forming which are not expelled by peristalsis and catharsis. The catharsis acts by liquefying the fecal material so that it can more easily pass into the cæcum. As a rule, the patient always knows, by his previous experience, that catharsis temporarily relieves the discomfort produced by this complication.

The third and last stage, in addition to the gastric symptoms, is manifested by more marked local symptoms, such as tenderness over McBurney's point and leucocytosis. This is the stage when the peristalsis of the appendix has completely failed, the stasis being very marked and the appendix, instead of being an active organ with normal peristalsis, is dead insofar as peristalsis is concerned. At this time the surgeon does not need the aid of the X-ray for diagnosis.

It is absolutely erroneous to say that from a Röntgen ray standpoint we should be guided by drainage in determining whether or not a patulous appendix should be removed. Probably at the moment the röntgenogram is made the appendix will be observed draining nicely, but the same examination could be repeated in several days with the result that this same appendix would show considerable stasis. There are so many factors that rule out drainage as a dependable sign. If the patient permits himself to become constipated the drainage of the appendix will be poor. If he takes a purge the drainage of the appendix will be good. If fecal concretions occur these will interfere with drainage until they are expelled. So it is observed that drainage of the appendix is easily influenced by the habits of the patient. The dependable röntgenological signs are those that have been enumerated in this paper and it is a careful comparison of these with the clinical findings that will result in the most reliable diagnosis.

From the above study of the various stages of the patulous appendix it is observed that to a large extent the important witnesses of the damage being done by the open appendix are found in the stomach. They are hyperperistalsis, spasm of the pylorus and duodenum and delayed emptying time of the stomach. If coupled with these findings an open appendix is found, we are justified in saying it is pathological. If the ileocæcal adhesions are present these tend to strengthen our



FIG. 1.—Patulous appendix during the first stage. Note that the appendix twines itself around the caecum vigorously in an attempt to empty itself. An appendix of this kind invariably produces marked reflex disturbances of the stomach.

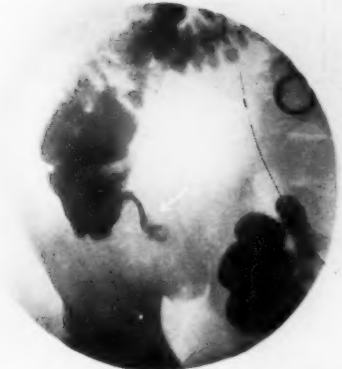


FIG. 2.—The same appendix as Fig. 1, two hours later. Note the appendix has changed its position and apparently the peristalsis is very energetic in its attempt to empty.



FIG. 3.—The same appendix four hours later than Fig. 1. Note that the appendix has again changed its position and the peristalsis is still very vigorous. It is during this stage that the gastric symptoms predominate.

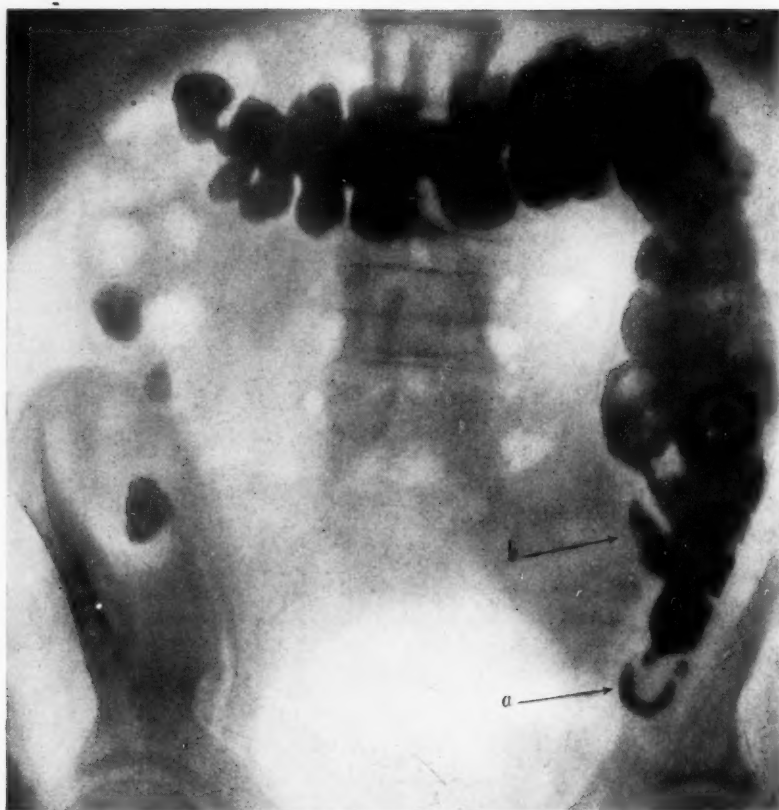


FIG. 4.—Patulous appendix during the second stage. The peristalsis is not so vigorous, neither is the appendix so freely movable as in the first stage.



FIG. 5.—Same appendix as Fig. 4, two hours later. Note that the appendix still holds the horse-shoe shape, as in Fig. 4.

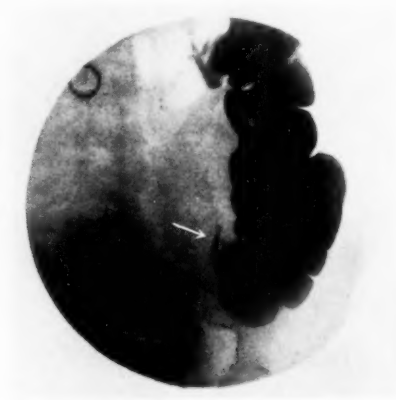


FIG. 6.—Patulous appendix of the third stage. At this time the appendix requires a number of days to empty the bismuth.

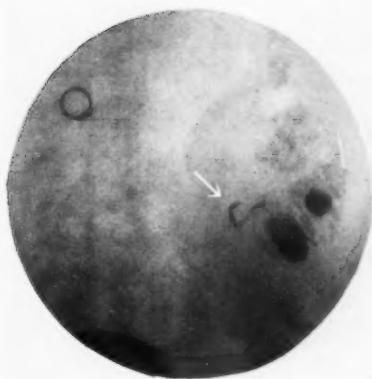


FIG. 7.—Same appendix as Fig. 6, twenty-four hours after the opaque meal. Note the cæcum has almost entirely emptied itself of the contents but the appendix is still filled.



FIG. 8.—Same appendix as Fig. 6, thirty-six hours after the meal. Note that cæcum has entirely emptied itself, but the appendix remains filled. It is this type of the patulous appendix that gives sufficient clinical symptoms to make a diagnosis without the aid of the Röntgen ray.



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diagnosis. The pathogenicity of the patulous appendix should not be measured entirely by drainage, but rather by the acuteness of the various röntgenographical signs that have been mentioned above.

My belief is that when the muscular contraction at the appendiceal orifice, the valve of Gerlach, the peristalsis, or whatever the mechanism is that guards the appendiceal orifice, first becomes incompetent there results a compensatory hyperstalsis of the appendix. And gradually, for some reason, probably the increased pressure of fecal material, there is a failure of compensation and the appendix can no longer empty. Then we are face to face with a late stage of appendicitis. It is on the same principle as the changes occurring in a heart lesion. There we first have a compensatory hypertrophy of the heart, later a failure of compensation. In the appendix we first have a compensatory hyperperistalsis, later a failure of peristalsis.

Conclusions: First, there is a röntgenological symptom syndrome associated with the patulous appendix, the detection of which is sufficient evidence of an abnormal appendix. Second, a patulous appendix, even though its drainage is good, is abnormal. Third, the röntgenological evidence of the damage being done by the patulous appendix is present in both the stomach and ileocæcal region.

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RENAL TUBERCULOSIS

By A. G. RYTINA, M.D.

OF BALTIMORE, MD.

ASSOCIATE PROFESSOR OF GENITO-URINARY SURGERY, UNIVERSITY OF MARYLAND AND THE
COLLEGE OF PHYSICIANS AND SURGEONS

(From the Genito-Urinary Department of the Mercy Hospital)

DURING the past few months the writer has seen a number of cases of renal tuberculosis, several of which exhibited features of sufficient interest to merit recording.

The first case shows that an almost generalized tuberculosis of the genito-urinary tract may be present without the production of any grave symptoms and that following radical removal of the chief foci, rapid, spontaneous retrogression of the disease in the remaining organs can take place.

Case number two proves the erroneousness of the teaching of some surgeons that tuberculosis of the kidney can be diagnosed by inspection and palpation of the organ at the time of operation. Indeed, bisection of the organ from pole to pole may fail to reveal the seat of an extensive tuberculous process. This point is worthy of emphasis, as the author has seen, in the last few years, several cases of renal tuberculosis which showed no evidence of its existence upon the surface of the kidney, but on section and examination of its interior a most advanced tuberculous condition.

The moral of this is, that the diagnosis of renal tuberculosis should be made prior to operation by the employment of the cystoscope, ureter catheterization and functional tests, and once having determined the diagnosis, its removal should be resorted to, irrespective of its normal surface appearance at the time of operation.

The third case indicates that an entire kidney may be destroyed by tuberculosis and exist for many years without producing any renal symptoms or change in the general physical well-being of the individual. This case also shows the advantage of kidney functional test in surgical renal conditions and at the same time shows that it is not fool-proof.

CASE I.—History (abstract) July 13, 1916. No. 2791. G. A., aged thirty-four, single. Referred by Dr. A. McGlannan. Complaint: Discharging fistula from scrotum.

Family History.—Negative, except that one brother died of "galloping consumption."

Past History.—Had diphtheria at the age of seven years, no other children's diseases. Had gonorrhœa three times, the first

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ten years ago and the last about a year and a half ago. In April, 1913, began complaining of ill health, and a diagnosis of pulmonary tuberculosis was made in December, 1913. Was then admitted to a sanatorium where he has remained until present time.

Present complaint dates back to one and a half years ago, when patient had his last attack of gonorrhœa. He then complained chiefly of frequent micturition, eight or ten times during the day and once or twice at night, and this condition has persisted to the present time. In November, 1913, noticed that blood appeared at the beginning of micturition; this lasted one week, and has not returned since. Has had burning during urination. While the force of stream has been good he has complained of hesitancy and occasionally the stream would be divided. Sexual desire was good until he entered the sanatorium, since then he has had none. Has no nocturnal emissions. Patient is nervous but sleeps well. Appetite was good until he was admitted to sanatorium. During the first few months there he lost 18 pounds. At first had cough, night sweats, and high temperature, but at present has none of these symptoms, present evening temperature is 99°.

Examination.—There is no discharge from meatus. Both the right globus minor and major feel nodular. The globus major is larger than the minor and tender and painful to touch. The globus minor is about the size of a pea; the major about the size of the end of the little finger. There is a fistulous tract leading down into the right epididymis. The left epididymis is enlarged slightly and feels nodular throughout. *Urine:* Glass 1 cloudy with shreds, glass 2 very cloudy. *Centrifugalized specimen:* Fresh specimen shows many pus cells, no red corpuscles, no organisms. Stained specimen shows no tuberculous bacilli or any other organisms, but many pus cells. Prostate not enlarged, median furrow present. On the right lobe can be felt two nodular areas about the size of small pea; one nodular area on the left lobe. Right seminal vesicle is enlarged and nodular and about the size of a lima bean. Left seminal vesicle palpable but apparently not involved. Bougie a-boule passed into bladder without meeting obstruction. Phenolsulphonephthalein injection given intramuscularly shows an elimination during the first hour of 43 per cent. and second hour 13 per cent. Cystoscopy July 13, 1916: Cystoscope entered with ease. Residual urine 15 c.c. Bladder capacity 450 c.c. No intravesical enlargement of prostate. Several ulcerated areas present in bladder. No stone or tumor mass present. Ureters seen and catheterized with ease; clear urine obtained from the right ureter and cloudy from the left. Functional test given intravenously: Right kidney appeared in ten minutes; first half hour 13½ per cent., second quarter of an hour

5 per cent. Left kidney appeared in nine minutes, first half hour 11 per cent., second quarter of an hour trace, leakage 20 per cent. Total output in three-quarters hour 49½ per cent. Urine: Centrifugalized catheterized specimen. Right kidney showed red blood-cells and epithelial cells, result of trauma. Left kidney showed red blood-cells, epithelial cells and pus cells. No tubercular bacilli on either side. A few strepto-bacilli on left side. Albumen positive from both sides.

Diagnosis.—Tuberculosis of right and left epididymis, prostate, right seminal vesicle, left kidney.

Operation (July 13, 1914).—Left kidney removed, oblique lumbar incision, by Dr. McGlannan, assisted by the author. Kidney larger than normal, both upper and lower poles were soft. Numerous tubercles present over the surfaces of the kidney. On section in both upper and lower poles there were numerous abscess cavities filled with pus. Several areas in cortex were involved. Pelvis somewhat dilated. Patient made an uneventful recovery and was discharged. Microscopic sections showed typical tuberculosis.

June 12, 1915: Patient returns saying that his weight reached one hundred and fifty-one pounds, but has recently dropped to one hundred and thirty-six. Has slight discharge coming from incision in scrotum on right side. Left side feels normal. Kidney incision healed. No cough, no burning, no frequency, urine practically clear, contains several shreds, albumen negative, pus negative. Prostate not increased in size, median furrow present. Right lobe of prostate soft, except one small area about the size of a pea which is indurated. The left lobe at the upper pole is slightly indurated. Right seminal vesicle somewhat large and indurated but smaller than before. Left epididymis feels normal in contradistinction to what it was before operation.

Discussion of Case.—Here is a patient with an advanced tubercular process of the left kidney, a tuberculosis of the bladder, prostate, one seminal vesicle, both epididymes, as well as an advanced phthisic condition, seeking relief from a small discharging fistula in the left side. Only a systematic interrogation of the entire genito-urinary tract by means of a careful examination of the urine, the employment of the cystoscope, ureter catheterization and functional tests revealed the true condition. Moreover, it reveals how a general physical debilitation may be overcome and how improvement and spontaneous arrest may be obtained in such important remaining organs as the lungs, bladder, prostate, seminal vesicles and epididymis by radical removal of the organ or organs most advanced or offending.

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CASE II (December 28, 1915).—History No. 3955. Diagnosis: Tuberculosis of left kidney, tubercular cystitis. Miss E. R., aged eighteen, referred by Dr. O. O. Cooper, Hinton, W. Va.

Family History.—Father died of tuberculosis, nothing else of importance.

Past History.—Negative to all diseases except diphtheria. Has had bladder trouble for five years.

Menstrual History.—Menstruation started at the age of sixteen years, but was very irregular, occurring as a rule about every two months; flow very scanty and lasted only a few days.

Present Complaint.—Began five years ago when patient noticed blood in her urine. At the same time she had frequent urination, voiding every few minutes, both day and night. When the desire to void came on she would urinate just a few drops each time with a burning, stinging sensation, she would also strain a great deal, causing a slight terminal hæmaturia. If she withheld her desire to void the urine would dribble away. Several times she had incontinence in bed at night. During the past five years these symptoms have become aggravated. Two cystoscopic examinations were made and she has been treated without getting relief. Was told she had a bladder tumor and needed an operation. Has lost about five pounds in the past few months.

Examination.—Urine is very cloudy; microscopic specimen shows many pus cells and a few red blood-corpuscles, albumin +++, no sugar. Cystoscope enters with ease. No residual urine. Trigone much inflamed and thick masses of pus are seen on trigone and around ureters. No evidence of stone or tumor. Few trabeculations present. Ureters not catheterized, as they cannot be seen. Phthalein test 50 per cent. one hour after intramuscular injection.

Operation (December 29, 1915).—Suprapubic cystotomy performed in the usual way. As the bladder was approached the superior wall felt very hard, but not nodular, having the feel of a bladder tumor. An incision was made into this and it was found to be due to the thickened wall. No ulcerations were found in bladder, no stone nor tumor. Trigone looked very much inflamed. Tube was inserted and after three days drainage continued with Davis drainage tube.

January 5, 1916: Patient is weak, urine much clearer.

Bladder draining (February 15, 1916): Patient has been in bed since operation. Feels much stronger and suprapubic wound looks well. Drainage has been kept up and urine looks much clearer. Cannot void through urethra yet.

April 8, 1916: Following suprapubic operation, the pain in suprapubic region disappeared or improved, but the urine remained full of pus. Patient developed measles while convalescing

and was isolated for three weeks. During all this time bladder irrigations did not benefit markedly the pyuria. Following the attack of measles she was again cystoscoped (April 1, 1916). Bladder not so irritable, right ureter was seen and catheterized, showing normal urine in every respect and 50 per cent. phthalein after half an hour following intravenous injection 6 mg. Left ureter could not be catheterized and result obtained transvesically showed no function from that side. Diagnosis of dead left kidney and compensatory right kidney was thereupon made.

For the last few weeks she has been running slight temperature and normal respiration but the pulse has varied between 120 and 160. Blood count showed 32,000 leucocytes. There was tenderness in the region of right kidney but no pain in the left.

Operation (April 8, 1916).—Lumbar left nephrectomy. Ether anæsthesia. The kidney easily removed and showed only a large pus sac, full of pus, which, when washed out, left a kidney which was nothing but a large sac. No kidney parenchyma seen. Ureter sewed into a rubber tube and two gauze cigarette drains passed down. Patient returned to ward in good condition.

Third day: Patient running high temperature and rapid pulse. Both renal and suprapubic wounds draining.

Twentieth day: Patient has gradually been improving. Renal wound is healing nicely. When suprapubic wound closes, as it has done on several occasions, temperature is higher.

Four weeks: Temperature 99, pulse 116. Both wounds still draining but feels stronger. Patient sent home in weakened condition with both fistulæ draining.

Nine and a half months: Letter. Still very weak, kidney wound closed. Bladder fistula still open.

Discussion of Case.—As the patient's general physical condition was excellent, with normal pulse and temperature, a normal functional output, an entire absence of kidney symptoms during the five years of her complaint, it was decided for two reasons to do a suprapubic cystostomy, first, to make sure of the diagnosis, which was impossible on account of the unsatisfactory cystoscopy, and, second, it was believed that vesical drainage would be helpful if a mere cystitis was present, particularly as all symptomatic treatment had been futile up to this time. At the time of operation (suprapubic) the small, thick, contracted bladder gave us our first suspicion of tuberculous cystitis. Following the bladder drainage, the painful symptoms subsided materially, but the failure of the urine to show marked improvement indicated an involvement of the one or both kidneys. The patient began after the operation to lose weight and developed a septic temperature and rapid pulse out of

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all proportion to the interference instituted. We waited until December 29, 1915, for her pulse and temperature to improve before attempting another ureter catheterization. This time we succeeded in catheterizing the right ureter, but it was impossible to see the left. Accordingly the urine and function from the left was obtained transvesically through a catheter introduced into the urethra. We were surprised to find the urine coming from the right kidney perfectly clear and free of all pathological elements. Phthalein test from this side showed an output of 50 per cent. The output from the left side obtained transvesically was nil. The diagnosis of an advanced left pyonephrosis was now easily made, with a compensatory hypertrophy of the right kidney. The combined functional test being normal tended with the absence of the other kidney symptoms to exclude renal involvement. Its value was more than ever emphasized to me, even if it was not fool-proof, and was the only factor which made possible the true diagnosis. The development of pain over the region of the right kidney was misleading and a colleague suggested that I might have been mistaken in the ureter catheterized and thought if she had a kidney involvement it must be, on account of this pain, in the right side. As already indicated the kidney was entirely destroyed, its remnant being a large membranous sac filled with purulent material. It seems most curious that a large pus sac of this size could lodge within the interior of the abdomen for so many years without producing any symptoms referable to it. As the patient has had bladder symptoms for five years, it is obvious that the kidney condition must have existed considerably longer. It is also worthy of notice that the patient's general physical condition, which up to the first operation was excellent, was greatly interfered with and was not even benefited after the removal of the offending kidney.

CASE III (January 4, 1916).—No. 4073. J. H. W. History (abstract), aged forty-one. Referred by Dr. E. H. Hutchins.

Family History.—Negative except that his wife died of tuberculosis.

Past History.—Had the usual diseases of childhood, including scarlet fever. Says he had remittent fever fourteen years ago. No gonorrhœa or lues.

Present complaint dates back to the first part of September, 1915, when patient noticed a burning sensation at glans penis at the end of and following micturition. This gradually became worse. At that time voided about every hour during the day, very seldom at night. At present still voids about ten or twelve times during the day, also several times at night. These were practically the only symptoms. Patient has fair appetite. Has slight

cough in morning. Is restless at night and several times has had night sweats. No chills or fever. Sexual desire normal, no nocturnal emissions. Examination: External genitals normal, no discharge. Testicles normal, inguinal glands normal, meatus small. Urine glass 1 and glass 2 very slightly cloudy and contains a few shreds. Microscopic examination shows the presence of pus without organisms by the ordinary staining methods. Phthalein test shows an output of 60 per cent.

January 6, 1916: Cystoscopy. Cystoscope enters with ease, no residual urine. Bladder capacity about 500 c.c. Tone good. No intravesical enlargement of prostate. Trigone normal. No trabeculations. On the superior wall of bladder is a small ulcer about the size of end of little finger. Edges red, base looks fairly healthy. Ureters seen after injection of 2 c.c. of a 4 per cent. indigo-carmin and left ureter catheterized. Catheter could only be gotten up about $\frac{3}{4}$ inch in right ureter. Centrifugalized urine from left ureter showed no pus cells, red blood-corpuscles from trauma. Indigo-carmin appeared on both sides in 7 minutes.

January 13, 1916: Cystoscoped again with same results.

February 4, 1916: Cystoscoped third time, unable to catheterize right ureter. In attempting to do so, used a small calibre bougie to see if same could be entered and mucous membrane at ureteral orifice was punctured. An intravenous injection of phthalein was given and 35 per cent. was collected from left ureter, 30 per cent. was collected transvesically, but there was leakage beside the left catheter.

April 2, 1916: Meatus very hard and indurated. Meatotomy performed and patient again cystoscoped. Left ureter catheterized with Garceau catheter. Indigo-carmin 4 per cent., $\frac{1}{2}$ c.c. given intravenously appeared in seven minutes. Indigo-carmin cleared both sides in one and a half hours. Phthalein given intravenously appeared in three minutes on the left side and five minutes in bladder urine. Found no leakage beside catheter this time. Output first half hour from left side 34 per cent., output first half hour from bladder urine 25 per cent.

On two occasions patient was examined for tubercle bacilli and on both occasions numerous clumps of bacilli were found. Strict precautions were taken regarding technic for obtaining same.

Operation (March 13, 1916).—Right kidney exposed in the usual way through lumbar incision (oblique). Kidney was easily and rapidly delivered, no adhesions were present. On exposure of kidney the size, shape, color and consistency seemed normal in every respect. Kidney was then bisected at a point a little behind its middle. Careful examination of interior of kidney showed no evidence of tuberculosis whatever. However, on account of

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difference in function on the two sides and the probable stricture of the right ureteral orifice, it was believed that there must be somewhere in the kidney a tuberculous process. Because of this the kidney was removed in the usual way. The ureter was tied as low down as convenient, touched with pure carbolic and then pulled up inside of a rubber drainage tube and anchored there. The wound was then closed around the tube after two pieces of iodoform gauze were placed around in the usual way.

Examination of the kidney after removal, on cutting it so as to expose the pelvis, showed a thickened cedematous condition of the lower half of the pelvis and upper part of the ureter. Everywhere the pelvis shows ulceration and is covered with caseous deposits. On more minute examination many small, irregular-shaped and sized tubercles are found. At the lowest end of the pelvis, at a point where the last two pyramids communicate, a definite tuberculous ulceration is present, which probably invades the apex of the pyramids at that point. Situated at the middle of the kidney on the right side is a small area of caseation about the size of a three-cent piece. It is circular in outline and the base is definitely caseous. The rest of the kidney looks normal macroscopically.

Blocks made from pelvis, from lower pole at point where last two or three pyramids communicate with pelvis, and from small tuberculous area felt in middle of kidney extending from pelvis, showed typical tuberculosis. Section from ulcerated meatus showed inflammatory ulceration.

Diagnosis.—Tuberculosis of right kidney, right ureter and bladder. Stricture of right ureteral orifice.

Discussion of Case.—This case reveals several points of practical importance. The diagnosis of right kidney tuberculosis was based on the strictured condition of the right ureter orifice, the lowering of the function, as compared with its fellow, early tuberculous ulcerations in the bladder and the demonstration in the urine of tubercle bacilli. At the time of operation, having been convinced of the diagnosis and the knowledge that surface appearance of the organ warranted no conclusion against its being tuberculous, I would have removed it without hesitation. But out of deference to the suggestion of Dr. Hutchins I bisected it from pole to pole, beginning my incision as is usual, a short distance behind the middle line, with the consequence that the division brought us outside the pelvis. At this stage, with all findings still against tuberculosis, the supposition seemed an erroneous diagnosis and the need of replacing the kidney within its bed appeared necessary. It was only after a discussion of the facts which led up to the diagnosis in which several other surgeons took part, that it was decided to remove

the kidney. The opening up of the pelvis demonstrating not only tuberculosis, but an advanced process therein, proved the soundness of the judgment, which could only have been obtained by conviction based on the employment of careful study preliminary to operation. Secondly, the case is interesting in the presence of an advanced and extensive process in the pelvis and only a slight involvement of one renal papilla. Tuberculosis of the kidney is usually hæmatogenous in origin and the disease is usually initiated by the deposit of fine and infective emboli in the finer terminal arterioles and capillaries of the organ. The usual seat of the disease is scattered more or less widely through the substance of the cortex and parenchyma. Pelvic involvement is secondary and occurs as a result of the extension of the process by a direct continuation of tissue. It is noteworthy, therefore, that the disease began in the pelvis rather than in the cortex or parenchyma. The seat of the disease also explains the equal time appearance of indigo-carmin and illustrates beautifully the sensitiveness of the phthalein test. As there was only a very slight involvement of the renal secreting substance, there was only a correspondingly slight reduction of the phthalein output as compared with its fellow. The almost clear urine was also a singular feature. The ulceration at the meatus resisted all local treatment and behaved clinically like one would expect with a tuberculous ulceration. We were convinced of its tuberculous nature and were surprised at the pathologist's report being non-tuberculous. This feature would seem to indicate the need of trying to avoid meatotomy in suspected cases of genito-tuberculosis. For various reasons, I have done meatotomy many times and have never observed this complication before. Inquiring among several colleagues has brought the response that they have never witnessed such a complication in their experience.

CONCLUSIONS.—While it seems utter folly to attempt to draw any conclusions from so few cases, nevertheless, each represents a type that we are constantly encountering and makes the following ones justifiable and worthy of consideration.

1. A more or less generalized genito-urinary tuberculosis may be present with practically no symptoms.
2. Removal of the most advanced or offending organ or organs where possible may lead to the spontaneous arrest of the remaining ones.
3. Exploratory diagnosis of renal tuberculosis by inspection and palpation at the time of operation is entirely erroneous; indeed it is possible that bisection of the kidney from pole to pole at the time of operation may fail to reveal the site of the infection.
4. Tuberculosis of the kidney may exist in an advanced degree for many years without causing any symptoms referable to it.

REDUPLICATION OF THE URETER*

By JOSEPH F. GEISINGER, M.D.
OF RICHMOND, VA.

ASSOCIATE IN GYNÆCOLOGY, MEDICAL COLLEGE OF VIRGINIA; ASSISTANT SURGEON, STUART CIRCLE HOSPITAL

WHEN one fully appreciates the complexity of the embryologic process which finally deposits the normal kidney in its permanent resting place in the lumbar fossa, together with the associated and simultaneous readjustment of structures at the lower end of the ureteral tract, he will not fail to bear in mind the possibility of an anomalous element in any unusual clinical picture involving the urinary apparatus.

As a rule, we are too prone to predicate all our diagnostic premises on basic anatomy and to overlook the possibility of aberrant types. As a result of its tortuous embryology, the kidney is peculiarly liable to maldevelopment in one form or another. In fact, as noted by C. H. Mayo, anomalies in the genito-urinary system are more frequent than in any other part of the body. This fact, with its medical and surgical significance, is not sufficiently appreciated, particularly as concerns the anomalies of lesser degree. Horse-shoe or ectopic kidneys, for instance, have become more familiar to the average surgeon than realization of the fact that a third ureter may lead the way out of a puzzling situation or that a duplicated pelvis may not only contribute an etiological factor, but at the same time invite a conservative surgical remedy. Kelly and the Mayos, the latter with the able assistance of Braasch, have done much to open up this field.

Embryologic Basis of Anomalies.—The present report considers only one form of anomaly—the supernumerary ureter—and is further limited to that type of it which presents a bladder orifice at one end and an independent pelvis at the other.

Reference to the developmental stage will explain the malformation. At an early period the future rectum and bladder are represented by a common reservoir, the cloaca, which soon becomes divided into an anterior and a posterior segment. The latter finally becomes the lower end of the rectum and need not be further considered. The ventral compartment eventuates as the bladder and urethra and has attached to it two canals—the Wolffian ducts—each of which sends forth an offshoot and then in addition thereto proceeds to form in the male the head of the epididymis of the corresponding side, and also the vas deferens, the seminal vesicles, and the ejaculatory duct. In the female

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it relapses into a rudimentary structure known as Gartner's duct. Each of the offshoots mentioned becomes a ureter, the bud growing and dividing distalward until pelvis, calyces, and straight uriniferous tubules are all produced. Surrounding each bud, developing and ascending with it, is an independent group of cells of different origin—the renal blastema—which forms the secreting portion of the kidney.

Simultaneously further differentiation has been progressing at the lower end. The urorectal septum has now definitely separated bladder and rectum and the ureter itself, originally opening into the Wolffian duct, halts short of the caudalward travel of its parent so that the terminal orifice of the latter eventually lies anterior (in the urethra) and the latter posterior (in the bladder). Numerous possibilities are here opened, as Kelly notes. If the Wolffian duct and ureter fail to shift anteriorly from the cloaca before the urorectal septum grows down to divide the rectum from the bladder, the ureter opens into the rectum. If the ureter does not separate itself from the Wolffian duct, but accompanies that canal in its journey caudalward, there results abnormal connection of the ureter with those organs which arise from the duct, or else with the sinus urogenitalis and the organs developing out of this—the upper portion of the urethra in both sexes and the vestibule of the vagina in women. Finally, if the ureter does not remain isolated from the closely related Müllerian duct, it is attached in women to the uterus or the vagina. Some of these anomalies have been reported and have offered opportunity for ingenious surgery.

As for the ureter at its upper end, it may branch precociously, producing a Y-shaped canal, each limb leading to an independent pelvis, or there may result anomalies of lesser note with individual large calyces, pelvises of unusual shape and so on to a theoretically unending degree. When the division occurs some distance below the kidney and there are definitely two pelvises, the condition has an important surgical bearing. W. J. Mayo has successfully bisected several kidneys of this type.

None of these considerations explain the ureter duplicated throughout its entire extent with an independent pelvis at one end and an independent bladder orifice at the other. Various theories have been advanced. That the condition represents a third kidney or a fusing together of two kidneys on one side is no longer believed. True supernumerary kidneys are extremely rare and possibly do not exist at all. In all likelihood the simplest explanation is the best—that there is a double evagination from the Wolffian duct instead of one, or that the division of the single bud begins so close to the Wolffian duct as to appear as two separate outgrowths. One bud is situated higher than

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the other. The ureter which develops from the lower reaches the bladder first, usually in the place where the normal single ureter is found; "the upper continues its downward shifting together with the

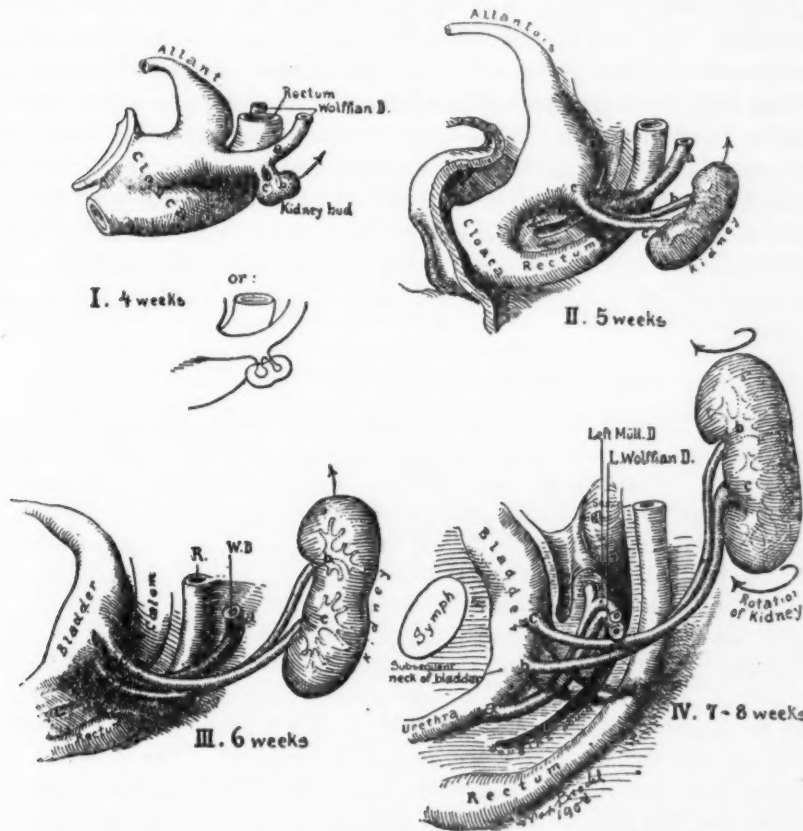


FIG. 1.—Kelly's diagrams and explanatory notes: Four diagrams illustrating the development of a kidney with divided pelvis and double ureter. The figure shows why the ureters cross and why the upper pelvis and ureter drain into the lower vesical orifice, while the lower pelvis and ureter drain into the upper vesical orifice. I, the double ureter starts from the Wolffian duct, *a*, either as two separate anlagen, *b* and *c*, or as an original single anlage showing a precocious branching which resembles a double anlage. II, through expansion of the lateral portion of the allantois, the lower Wolffian duct becomes dilated and the lower ureter, *c*, is the first to reach the allantois. The Wolffian duct, *a*, carrying the upper ureter, *b*, with it, shifts with the urogenital sinus, in a downward direction, between the allantois and the rectum, as shown by arrows, until the second ureter, *b*, also becomes implanted in the bladder, but further down and more mesially than the first, *c*. III, we here see a continuation of the same process of advance of the Wolffian duct with a greater separation of the duct from the ureter. IV, the Wolffian duct continues to travel downward with the advance of the urogenital sinus and finally becomes permanently lodged at the neck of the bladder, *a*, in the male; in the female, it continues still further down. This last picture represents the final arrangement, as seen in the adult. Note that the original order, *a, b, c*, as shown in first picture, is now reversed to *c, b, a*, at the bladder. (From "Diseases of Kidney, Ureter and Bladder," Kelly and Burnam, vol. ii, pp. 332-333, D. Appleton & Co., Publishers).

Wolffian duct, mesially to the first attached ureter, until it also reaches the urogenital sinus. The Wolffian duct, minus the ureters, continues to shift to a still lower level. If the two ureters are liberated in quick succession they will be found close together in the bladder; if a longer

interval prevails they are farther apart, so far that the upper ureter may be carried to or below the internal urethral orifice" (Kelly).

In our cases the orifices were always close together. Reference to Kelly's diagram (Fig. 1) will show that the ureters must cross each other and that the ureter from the upper part of the kidney must have a vesical orifice below and medianward to the orifice of the ureter coming from the lower part of the kidney. Our cases, however, differ slightly from those of Kelly and coincide precisely with those of Braasch who also notes that when complete duplication of the ureter exists there will be not simply one point of crossing, as stated by Kelly, but two—the first crossing occurring a short distance below the ureteropelvic juncture and the second a short distance above the bladder wall. Consequently the appearance would be as indicated in the pyelograms appended.

REPORTS OF FOUR CASES

CASE I.—Mrs. F. F., aged twenty-four, white, married four years; was delivered with forceps on June 10, 1910, with great difficulty. For two or three weeks she got along very well and then began to have an irregular fever which would go as high as 103 or 104 and then subside for an interval. This brought her to the hospital in August of the same year. Bladder disturbance was conspicuous by its absence, with the exception of a disagreeable odor to the urine and a large amount of microscopic pus. Locally a slight tenderness in the right loin was all that could be elicited. Cystoscopic examination showed nothing essential so far as the bladder was concerned. Right and left ureters were catheterized and the specimens were entirely negative. The diagnostician was nonplussed. Moreover, pus continued to appear in the urine and the patient to exhibit still more marked general signs of a pyelitis, which had been originally assumed to be the cause of her trouble. A second cystoscopic examination cleared up the mystery. A third ureteral orifice was now found on the right side and when catheterized promptly exonerated the diagnostician and revealed the source of the pus. Treatment directed toward this anomalous ureter caused rapid improvement in the patient, who, so far as known, has since been well. Unfortunately full notes were not made in this case and no X-ray plates were taken.

CASE II.—Miss M. G., white, unmarried, aged thirty, came for consultation on November 19, 1913, with a history of indigestion, constipation, and right-sided abdominal pain and soreness suggestive chiefly of appendicitis, though possible involvement of gall-bladder or pylorus could not be definitely excluded at this time. In addition she suffered with menstrual disturbances, the cause for which was revealed in a markedly retrodisplaced and somewhat

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enlarged and boggy uterus. Urinary history was negative. Operation was advised but was deferred one year, at the end of which period of reflection patient returned (November 2, 1914) with the same history accentuated and with the addition of a spell of fever, some left hypochondriac pain and a brief attack of bladder disturbance. Operation was now done, the appendix removed, and the retrodisplacement corrected. During a normal convalescence in the hospital the patient suddenly developed acute left-sided pain, fever, and a large amount of pus in the urine. Cystoscopic examination showed congestion of the base of the bladder with œdema and swelling around the left ureteral orifice. Right and left ureters were catheterized, specimens obtained, and kidney pelvis irrigated with argyrol. At this time it was noted that the flow of urine on the right side was free and on the left very slow; also that but a small amount of the argyrol entered the left pelvis. Specimens showed pus on the left side with normal urine on the right. The patient made a prompt recovery and soon thereafter left the hospital. Two months later her urinalysis was practically negative.

In September, 1915, the patient brought her sister in for a slight operation. At this time her own health was excellent, digestive and menstrual disorders had ceased and her only complaint was slight pain in her back and mild bladder disturbance at the time of her monthly periods. Advantage was taken of the opportunity to again inspect her bladder to determine if any evidence was left of the antecedent pyelitis. The bladder was now entirely normal and the picture at the left angle of the base of the trigone was no longer obscured by œdema and swelling. It was then noted for the first time that two distinct ureteral orifices were situated at this point, separated about one-quarter inch from each other. All three ureters were catheterized and specimens obtained. Each ureter appeared to have a dripping schedule independent of the other two. A colored solution injected through one of the left catheters to the point of distention of the pelvis (pain) failed to return through the other left catheter, suggesting independent pelvis. All three specimens were negative on microscopic examination, with the exception of a small amount of blood, probably traumatic, from the distal ureter on the left side. Two days later a collargol pyelo-ureterogram was made with leaded catheters. The plates (Figs. 2 and 3) showed the tip of the right catheter about three inches below the pelvis, which was only partially filled, two calyces showing. On the left side each catheter ran directly to an independent pelvis which had no connection with its fellow. The median ureter on this side crossed the lateral ureter a short distance above the bladder and recrossed it a short distance below the pelvis, which was higher placed and much smaller than the

other. Evidently it was this rudimentary pelvis which was the seat of the original pyelitis and which was irrigated at the first examination, thus accounting for the tardy flow of urine noted at that time and the small amount of argyrol that could be injected. The subsequent history of this patient, up to the present time, has been entirely uneventful.

CASE III.—Mrs. M. C., aged thirty-eight, white, widow. In 1908 she underwent an emergency operation in another city for appendicitis, but the only pathology discovered was a nest of adhesions in the left side which were separated. The surgeon failed to find the appendix.

Two years later she came complaining of frontal headache, backache, nervousness, and lower abdominal pain, for which she was referred for medical treatment. Six months later she returned, having had an attack of vomiting, diarrhoea, urinary disturbance, and severe right-sided pain extending from kidney area to neck of bladder. The records show that a cystoscopic examination was made at this time and that "both ureters were discharging freely." The third ureter on the right side was not discovered. Urinalysis then and subsequently showed albumin, urates and pus.

One year later (1912) the patient reappeared, this time with headache, vomiting, anorexia, severe pain in her right flank and marked tenderness over the kidney and in the costovertebral angle. Her urine was cloudy but her bladder disturbance had subsided. A diagnosis of post-cæcal appendicitis or pyelitis was made, and through a right rectus incision her appendix was removed and some more adhesions were separated. After a stay of several weeks in the hospital she left "recovered." Two months later she returned with hemorrhoids, which were sutured, resulting also in "recovery." In less than six months all her old complaints revived—right-sided pain, headache, bladder disturbance, bearing down in region of right kidney. She also now suffered with indigestion and severe constipation. Urine contained a few pus cells. This condition continued until March, 1913, when a final diagnosis of chronic colitis with adhesions was made. Operation was done by Dr. J. C. Bloodgood and consisted of removal of a thickened and adherent cæcum and ascending colon, with anastomosis between ileum and transverse colon. Constipation now changed to diarrhoea, but in the main the patient's condition improved for a few months. After this she relapsed. Pain and tenderness in her right side continued and grew worse. For nearly two years she continued a chronic invalid, her chief complaint being referred to her bladder and right kidney area. Cystoscopic examination (the first by the writer) again failed to reveal the third ureter but disclosed a cystitis which was treated locally.



FIG. 2.—Lower urinary tract of Case II, showing three ureters with radiograph catheters *in situ*. Note two points of crossing of duplicated ureters, as explained in text. (X-ray work by Dr. A. L. Gray, Richmond, Va.)

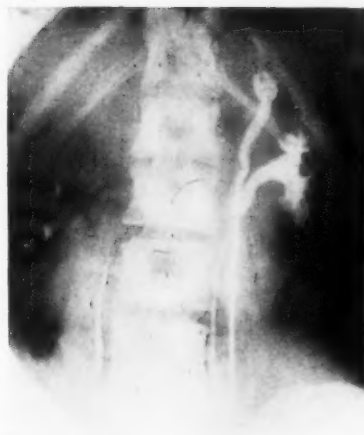


FIG. 3.—Upper urinary tract of Case II. On right side pelvis is incompletely filled, two calyces showing. On left side is beautifully shown upper point of crossing of duplicated ureters, each leading to an independent pelvis, the lower being entirely normal and the other typically rudimentary in appearance. (X-ray work by Dr. A. L. Gray, Richmond, Va.)



FIG. 4.—Lower urinary tract of Case III. The original pyelogram of this patient showed two points of crossing of ureters, as in Case II. The picture here shown, together with the one following, was taken very recently, and is selected because the outlines are clearer. The third point of crossing visible at this time is evidently due to displacement of one of the ureters by the dilating bougie. (X-ray work by Dr. A. L. Gray, Richmond, Va.)

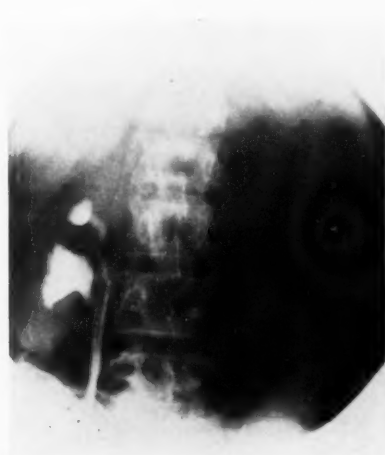


FIG. 5.—Upper urinary tract of Case III, showing two pelves, one of them being distinctly rudimentary in size and contour. (X-ray work by Dr. A. L. Gray, Richmond, Va.)

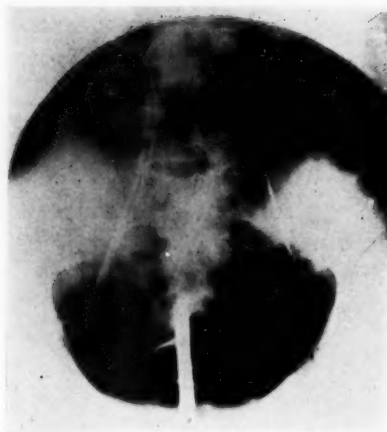


FIG. 6.—Lower urinary tract of Case IV. Upper point of crossing of ureters appears in this case to occur at much lower level than in other two cases. (X-ray work by Dr. A. L. Gray, Richmond, Va.)



FIG. 7.—Upper urinary tract of Case IV. Note unusual normal size and shape of duplicated pelvis. For purpose of clearer reproduction, outline of upper pelvis in this picture was retouched by the artist in strict accordance with original print and plate in our possession. (X-ray work by Dr. A. L. Gray, Richmond, Va.)

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About two weeks later another cystoscopic examination was made (January 20, 1915) and at this time a double ureter was located on the right side, the small pin-point orifice of the second opening being situated slightly in front and to the median side of the orifice previously catheterized. Microscopic examination of the specimens showed a small amount of pus and blood from each of the right ureters; the left side was negative. Some time later pyelograms were made. The left kidney was in normal position with a pelvis of normal size and shape. On the right side (Figs. 4 and 5) were clearly outlined two ureters independent throughout, not communicating at any point. The lateral ureter led to a lower pelvis and the median ureter to a pelvis higher situated, both pelvic shadows being atypical. Function of the left kidney (phenolphthalein intravenous injection) was 13 per cent. in fifteen minutes (normal 15 per cent.); right lateral ureter 9.5 per cent.; right median ureter 1.2 per cent.; leakage into bladder 7.5 per cent. The three ureters and pelvises were catheterized and irrigated three times. The patient was free of right-sided pain and bladder disturbance for more than twelve months. She has recently developed a recurrence and we have just succeeded in again dilating the supernumerary ureter which had re-contracted to such a degree that it would at first admit nothing larger than a fine filiform bougie. We have also enlarged the pin-hole orifice by splitting it up with ureteral scissors.

CASE IV.—J. N. C., white, male, married, aged twenty-four years, entered the Memorial Hospital in our service on December 21, 1916, two months after the presentation of this paper in its original form.

Ten weeks previously the patient began, for the first time in his life, to have frequent micturition, burning during the act, and tenesmus following it. Occasionally he saw a little blood after he had been straining a good deal. Following the onset of the trouble all symptoms persisted, the burning and tenesmus becoming a little worse, but the frequency a little better.

Patient had no other complaint, and there was no history of previous similar attacks. Sometimes he had slight indigestion, characterized by fulness after eating, but this did not occur often; no nausea, no vomiting, some tendency to constipation. He had no pain. A year ago he was in bed two weeks with pneumonia and several months ago he had a spell of "malaria" with chills and fever. He denied venereal disease of any sort. At the time of his appearance in the hospital his general health was good, he felt strong and vigorous, was keeping up his weight, and would have considered himself well if he could be rid of bladder disturbance.

General examination negative. Prostate negative. Posterior urethra negative. Bladder showed violent diffuse cystitis of bul-

lous type. Left ureteral orifice somewhat displaced outward but otherwise normal. Right orifice buried in a nest of small bullæ. On closer inspection of right side two distinct orifices were noted, one being situated slightly anterior and medianward to the other. Catheters were carried through both orifices for the full distance. Urine from one right ureter differed from the other in both color and dripping schedule. Collargol pyelo-uretrogram showed complete reduplication of ureters (Fig. 6) and independent pelvis (Fig. 7). The supernumerary pelvis appeared more nearly normal in size and shape than the others in this series. Laboratory reports on specimens of urine were as follows:

Bladder: Specific gravity, 1010; reaction acid, albumin, pus, red blood-cells, and epithelial cells. Stained slides negative for bacteria.

Left ureter: Microscopic negative. Stain negative. Culture negative.

Right median ureter: Few pus cells. Stain negative. Culture negative.

Right lateral ureter: Definite amount of pus. Stain negative. Culture showed growth of staphylococci.

Review of the case appeared to justify the diagnosis of cystitis secondary to pyelitis limited to the right side and probably to the pelvis attached to the right lateral ureter.

Under treatment, consisting of lavage of the renal pelvis with silver nitrate solution, iodoform emulsion injections into the bladder, and the usual internal medication, the patient made a very satisfactory recovery.

Significance of this Anomaly.—In presenting this report our object has been mainly to call attention again to the importance of a careful cystoscopic review of any renal condition. We have no delusions as to the importance of the exhibit as announcing anything extraordinary. While bilateral complete duplication of ureters is very rare, unilateral complete duplication is by no means uncommon. Braasch has reported several instances and the literature contains fairly good records of many more. Very recently (*J. A. M. A.*, May 27, 1916) Simon and Mertz, of La Porte, Ind., have cited one case with an excellent discussion. Cases II, III and IV in our list have occurred in a series of 100 patients with renal disease who have been subjected to cystoscopic examination during the past two years. Case I does not properly come in this series. It is taken from the office histories of my associate and chief, Dr. Charles R. Robins, and is added so as to give a complete record of our experience with the anomaly.

Not only do we not regard unilateral reduplication of the ureter as rare, but we are convinced that it is far more common than even the

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reports indicate. As for the skilled cystoscopist whose eye at once detects any vesical abnormality even of pin-point size, an aberrant ureter with bladder orifice will rarely escape observation *if he look for it*. But for those who only now and then catheterize ureters, a third orifice will easily and generally pass unnoticed even after repeated examinations. The chief reason for this is that having found and catheterized two ureters, the inspection at once halts, the possibility of a third never having entered one's mind. It is this point particularly that we wish to emphasize. We now invariably exclude the presence of abnormal ureters in the course of routine cystoscopy. If this plan were adopted universally we believe many more reduplications would be discovered and many more obscure cases cleared up.

The surgical significance of the anomaly is quickly apparent and is well exemplified in our cases. As stated at the outset, we limit our discussion to the supernumerary ureters with vesical outlet. If the orifice is situated elsewhere the clinical picture and the therapeutic considerations are entirely different: these cases fortunately are rare.

Any anomaly to some degree alters the normal physiology of the body and invites pathology. In the case of a kidney with two pelves and ureters one of them is more than likely to be of rudimentary size and function and peculiarly liable to disease. Infections in such pelves are common. Three of our cases illustrate this, the normal pelvis remaining unaffected. If the third ureter is not eventually discovered, primary catheterization of the other two may lead to exclusion of the urinary tract from further consideration, while the patient is hopelessly treated in some other direction. Should the condition progress to an involvement of the renal parenchyma, knowledge of the third ureter may open the way for a conservative surgical attack, the diseased portion of the organ being removed with its pelvis and the other half retained. Stone in the third pelvis or ureter may cause no end of confusion if only the other two ureters are catheterized. Various other considerations might be offered but they are easy to project for one's self. We call attention to only one; it is evident after a review of the history that the right-sided pain for which our Case III had such a variety of treatment was, in fact, of renal origin, and was due to stasis and distention of a rudimentary third pelvis, due to partial stenosis in a rudimentary third ureter. Furthermore, the history compels the belief that relief from pain was directly due to the relief from stenosis by means of the dilating ureteral catheter. We therefore feel that this case not only represents an anomaly, but properly comes within another group, the outstanding feature of which has been a ureter stenotic in greater or lesser degree. These will be considered in detail in a subsequent report.

ISOLATED SPRAIN-FRACTURE OF THE TRAPEZIUM PRODUCED BY INDIRECT VIOLENCE

BY J. L. BENDELL, M.D.

OF ALBANY, N.Y.

THE occurrence of isolated fracture of a carpal bone with the exception of the scaphoid is rare,¹ and except in crushing injuries of this region, fracture of the trapezium is extremely rare.²

The production of fracture of any member of the bones of the carpal group by any mechanism other than by direct violence is of such novelty that it may be looked upon as possible, but highly improbable.

Isolated fracture of the trapezium produced by forcible internal rotation of the wrist-joint is a lesion of such unusual occurrence that it has prompted the present communication.

The lesion *per se* is rare, and in this instance, at least, the mode of production is exceedingly unique, and so far as the writer is aware, is not mentioned in the surgical literature of the past ten years.

A careful search of the latter from 1905 through 1915, on the part of Miss Frances K. Ray, New York State Medical Librarian, and her assistant, Miss Cady, has failed to reveal a single instance of a case report such as herewith presented.*

Dr. Lewis A. Stimson, in a personal communication to the writer, has kindly furnished a reference to a case published by Ebermayer.³ The latter in a painstaking and scientific article entitled "Über (isolierte) Verletzungen der Handwurzelknochen," presents a series of cases with röntgenographic reproductions, among which is shown a fracture of the trapezium associated with fracture of the first metacarpal.

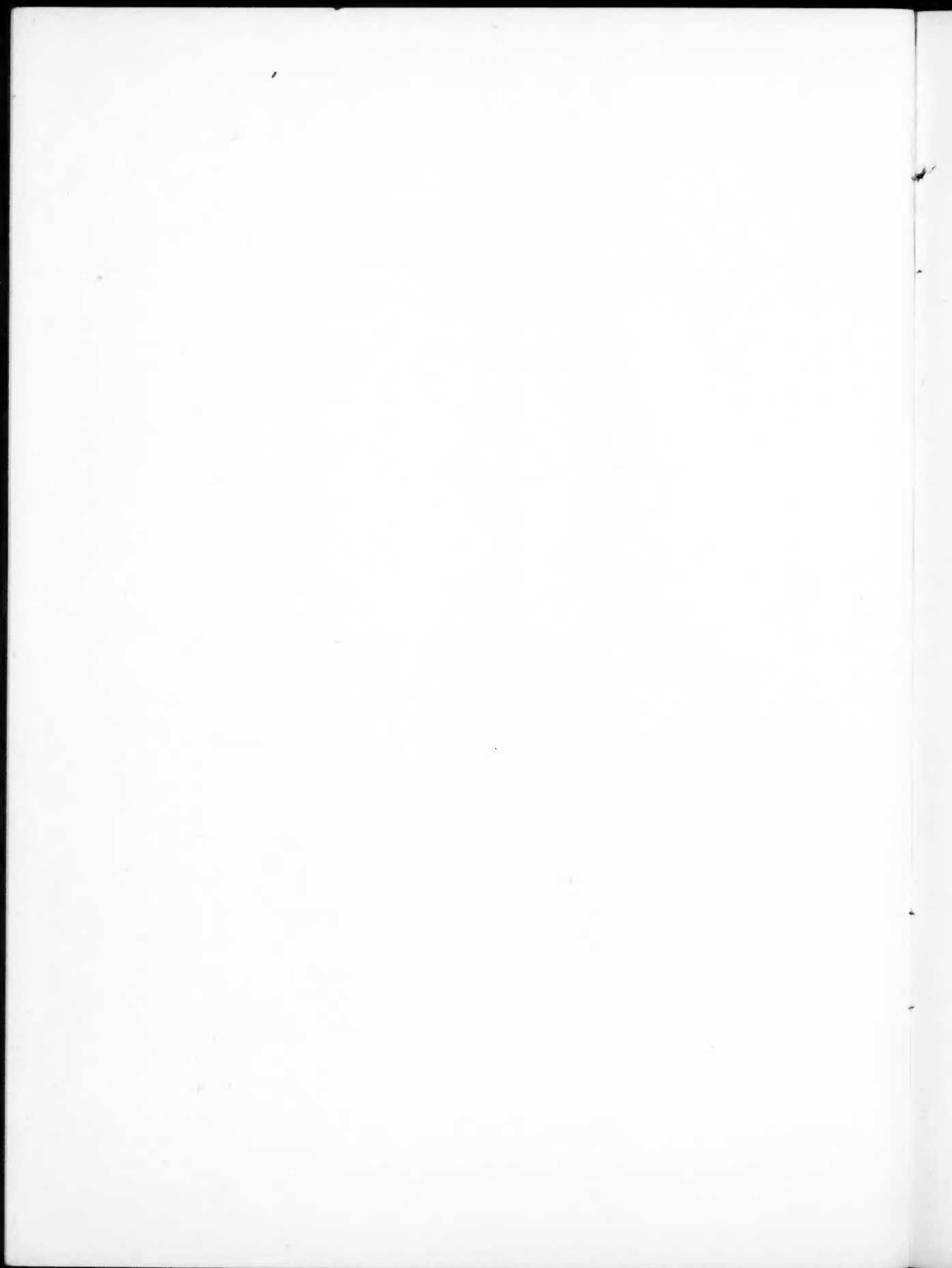
The mode of production of the fracture is not given, and the association of fractured metacarpal places the lesion somewhat foreign to the type of fracture we are presenting. The article itself, however, is probably one of the best general expositions of carpal fractures that has been published since the classic contribution of Codman and Chase.⁴

The most recent case report with röntgenographic findings is one that has come to the writer's attention during the preparation of this

* The production of the fracture through the mechanism of forcible internal rotation unaccompanied by any direct violence.



FIG. 1.—Isolated sprain-fracture of trapezium from indirect violence.



SPRAIN-FRACTURE OF TRAPEZIUM

article. It is a case reported by Perkins,⁵ showing a fracture of the outer end of the trapezium produced by a fall on the outstretched thumb and hand, the symptoms consisting of pain and swelling at the base of the thumb. Diagnosis of the condition was established only through the use of the röntgenogram.

From the above it is apparent that although the lesion in question may occur, nevertheless the literature is almost barren, at least for the past ten years, of reported cases.

Doubtless as in many other types of fracture long regarded as unusual and rare, the use of the Röntgen ray is showing the fallacy of regarding certain of these lesions as uncommon, and the case herewith reported may fall within this latter group, although the facts hardly warrant such an assertion.

Our case in question is as follows:

Mrs. A. N., aged forty-eight, seen on August 15, 1916, complaining of painful swollen wrist. On August 10, the patient, while turning the knob of a door with her right hand, gave the latter a sudden unexpected twist. She experienced a sharp pain in the wrist and noted that movement of the joint was accompanied by discomfort.

Within a few hours the wrist became swollen, the œdema extending along the hand and involving the fingers, so that movements of the latter were painful.

The patient was advised to use a liniment on the swollen parts, having been told by a physician that she was suffering from a "sprained" wrist. The œdema and pain became less, but a certain amount of disability and discomfort persisted. Upon examination there is noted cedema of the entire wrist, particularly of the dorsal surface, extending along the lower arm. Flexion and external rotation of the wrist produce a certain amount of pain, although there is discomfort when the wrist is moved in any direction.

No crepitus is obtainable and there is no apparent deformity, although the rather marked œdema over the dorsal aspect of the wrist is suggestive of a pseudo-silver-fork deformity. A röntgenogram taken by Dr. W. P. Howard, of the Albany Hospital, reveals a spicule of fractured trapezium (Fig. 1).

The hand and wrist were immobilized by means of a light plaster case, the fingers being left free. At the end of two weeks the case was removed and massage instituted. At this time the œdema had almost entirely disappeared and pain on motion was slight. At the present time (October, 1916) the patient is using her hand without any difficulty to perform the usual house

work, and beyond a slight muscular weakness the condition is normal.

Although the publication of a case report such as the above is interesting rather from a casuistic standpoint than from the practical surgical aspect, nevertheless, the relative rarity of the fracture coupled with the unusual mode of production is worthy of note. There is no question that the term "sprain," particularly as applied to ankle and wrist, covers a multitude of diagnostic errors, based not so much upon lack of personal skill as upon the unwillingness of many to utilize the Röntgen ray in their own work, or to refer cases of this description to the proper individuals, provided they themselves do not feel qualified to act as surgeons. This is not only true in a large degree as respects ankle and wrist but will hold good for a variety of lesions in which the use of röntgenograms for the determination of bone and joint involvement is indicated, as has been pointed out in a previous communication.⁶ The surgeon is brought in contact time and again with cases originally diagnosed as "sprain," "strain," etc., which in reality, as proven by röntgenogram, are fractures and sometimes dislocations.

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ARTIFICIAL CELL PROLIFERATION WITH HORSE SERUM IN THE TREATMENT OF BURNS

BY EDWARD PERCY ROBINSON, M.D.

OF NEW YORK

THE recent publication in the *British Medical Journal* of a contribution by Dr. R. J. Williams, regarding asepsis in the treatment of burns, suggests the timeliness of calling attention to what is as far as I know an original method of treatment at variance with that proposed by Dr. Williams, as well as with that practised by other physicians. It has for some time seemed to me that over emphasis has been given to asepsis, which may not only not assist but even retard natural processes of repair.

For some fourteen years the writer has been out of general practice and has been interested in special lines of work depending on the artificial stimulation of cell proliferation. His success in inducing growth of cellular tissue in cases of atrophy due to imperfect nutrition had long suggested the possibility of promoting through analogous processes the repair of tissues destroyed by burns due to fire, hot water or traumatism. In a practice limited to narrowly specialized lines no opportunity occurred for a practical application of the writer's notions until a recent accident to a relative presented a case with conditions difficult or even impossible of treatment by ordinary methods.

The patient, a woman forty-five years of age, severely scalded herself with boiling water. The injured surfaces were upper and middle third of right leg, from ten to twelve inches in length and four to eight inches in width, calves of both legs and ankle of left foot, deep burns on both buttocks and on left hip, superficial burns on right cheek. The surface area of devitalized skin exceeded one-third of the entire surface of the body. The burns were about equally of first and second degree in extent. Within a half hour of the accident the patient was taken to the hospital in Mt. Vernon, New York. First a temporary dressing of carron oil was applied and the patient placed under the care of Dr. J. J. Sinnott of the same city. On the following day the burns were dressed with an antiseptic ointment. An acute nephritis developed within twenty-four hours after the accident but rapidly subsided.

With so extensive a loss of skin, it was evidently impossible both to Dr. Sinnott and myself to bring about satisfactory epidermization through skin grafting, owing to the insurmountable diffi-

culty of obtaining a sufficient number of persons willing to part with the large area of skin necessary. Then there had to be taken into account the failures of graft to take that might be expected in treating vast second degree burns, some of which were ten inches in diameter.

While I had always believed from my long experience in artificially promoting tissue growth that burns could be successfully treated without skin grafting by supplying to the cells surviving on the wound's edges nourishment calculated to accelerate proliferation, the opportunity to try out my ideas found me not altogether prepared as to what cell food would produce most satisfactory results. Horse serum heretofore employed in hæmophilia neonatorum, hemorrhage from the umbilical cord, post-operative hemorrhage, etc., and as an application to the oozing surfaces of wounds, occurred to the mind as a possible resort. However, a search for information in current medical literature and inquiries at the Lederle Laboratory where this serum is obtained, afforded no light regarding its availability as a local application in cases of burns. So the experiment had to be made without supporting precedents.

The test of the horse serum was first made on the tenth day after admission to the hospital and several large burns of the second degree were selected. Two of these located on the buttocks were six to eight inches in width and about ten inches in length. Normal horse serum containing a small percentage of tricresol was sprayed on the marginal skin cells and the parts thus treated were covered with rubber tissue.

At this point it may not be out of place to mention that with tubes containing only enough serum for a single application, the tricresol acting as a preservative may be safely omitted from the preparation, thus preventing a certain amount of painful smarting during the spraying process and possibly accelerating cell proliferation.

The repetition of this treatment several times a day for ten days resulted in a complete recovery without complications, such as the formation of pus or of proud flesh. The marginal cells thus threw out new cells, not condemned to die of starvation in the devitalized areas, but nurtured by the plasma obtained from animal blood. Instead of requiring four or five months of treatment, as is usual in grafting operations, the patient was discharged from the hospital twenty-one days after her admission.

Dr. Sinnott pronounced this the most rapid case of healing within his experience and declared his intention of hereafter using serum in the treatment of burns, thus avoiding the tortures and uncertainties of grafting operations.

HORSE SERUM IN THE TREATMENT OF BURNS

To conclude with a final reference to the contribution in the *British Medical Journal*, aside from differing with Dr. Williams as to the efficiency of asepsis without artificial aid in cell proliferation, the writer is also of the opinion that in the treatment of burns an error is made in puncturing the blisters. By opening the blebs and allowing the liquid to escape, the surgeon is interfering with nature's provision of a sterile serum protected by a covering of skin, than which no man can substitute a better dressing. In accordance with this belief, in the case under consideration, the blebs were left unpunctured with most satisfactory results.

TRANSACTIONS
OF THE
NEW YORK SURGICAL SOCIETY

Stated Meeting, held November 22, 1916

The President, DR. CHAS. N. DOWD, in the Chair

CENTRAL SARCOMA OF THE LOWER END OF THE FEMUR WITH
EXTENSIVE INVOLVEMENT OF THE KNEE-JOINT SUCCESS-
FULLY TREATED WITH THE MIXED TOXINS OF ERYSIPELAS
AND B. PRODIGIOSUS

DR. WILLIAM B. COLEY presented a woman (not previously reported) twenty-one years of age, who was first seen in consultation with Dr. V. P. Gibney, at the Hospital for Ruptured and Crippled, in October, 1914. Family history negative; Wassermann negative.

Eight months previously patient first noticed pain in the left knee, while walking up and down stairs. This gradually increased in severity and shortly after was present even while walking on level surfaces. She consulted a physician who applied Buck's extension to the knee, with slight temporary relief. A little later she entered a hospital where a plaster-of-Paris splint was applied, which she wore for five weeks. No improvement was noticed; thereupon several teeth were removed, on the ground that she was suffering from osteoarthritis due to pyorrhœa. Later on she was placed upon specific treatment. In spite of these widely varied therapeutic measures, the swelling and pain increased, and the patient was unable to bear the weight of her body upon the limb. She was admitted to the Hospital for Ruptured and Crippled (Dr. Gibney's service) on October 24, 1914, at which time physical examination showed general condition good; heart and lungs normal; patient wearing a plaster splint. There was marked swelling and infiltration of the whole lower end of the left thigh and anterior aspect of the left knee. The knee was completely extended, with very greatly increased abnormal lateral motion, showing destruction or extreme laxity of the tissues. There was marked infiltration of the popliteal space, and moderate atrophy of the limb.

Measurements.—Left, 15, 15½, 12; right, 14¼, 14, 12.

The X-ray showed very marked expansion of the lower extremity of the femur; cortical substance thin and apparently on the point of breaking through; structure of bone disappeared.

In view of the extensive involvement of the knee-joint accompanied with great tenderness and extreme mobility, after careful examination and study of the X-ray plates, Dr. Coley concluded that the disease

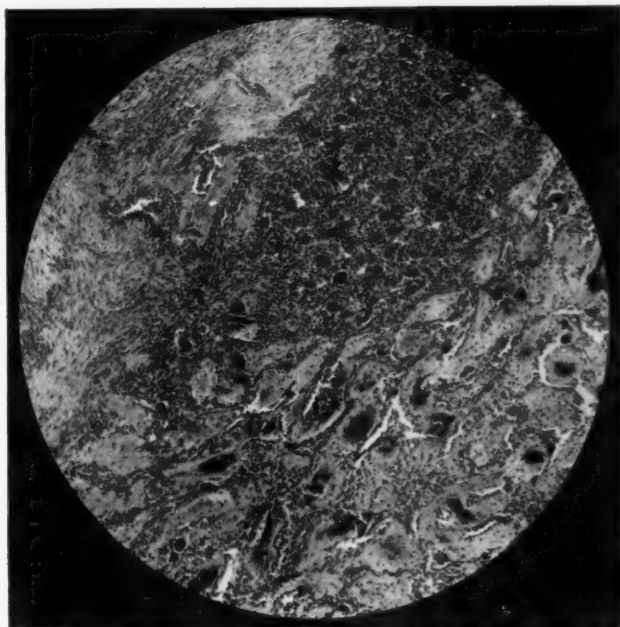


FIG. 1.—Very extensive sarcoma of femur involving knee-joint. Amputation refused. Recovery under toxin treatment after exploratory operation. Now well twenty-six months.



FIG. 2.—September 26, 1914. Sarcoma of femur involving knee-joint. Before treatment.



FIG. 3.—Well two years and two months. Disappeared under toxins following exploratory operation.

CENTRAL SARCOMA OF LOWER END OF FEMUR

was undoubtedly a central sarcoma which had pierced the cartilage of the joint, causing joint involvement and effusion. This condition is extremely rare and he had never, up to that time, seen a case similar to it with such extensive joint involvement. Dr. Gibney and Dr. Whitman also believed the condition to be sarcoma. They considered it too far advanced to justify conservative treatment, and strongly urged immediate amputation. This, however, was refused by the patient and her family. On November 6, 1914, an exploratory operation was made to obtain a piece for microscopic examination. On cutting down to the periosteum, a mass was found which occupied the entire lower end of the femur, the central portion of which was greatly expanded and occupied by a tumor having the typical clinical appearance of a sarcoma. It was quite vascular and penetrated into the joint; there was considerable effusion in the joint. As much of the tumor as possible was curetted out and the wound packed. Hemorrhage, which was severe, was fairly well controlled with tight packing, and the limb was put in a plaster-of-Paris splint. After microscopical examination Dr. F. M. Jeffries reported it as a "mixed-celled sarcoma."

A further examination was made by Dr. J. Ewing, who reported as follows:

The material consists of several broken portions of tumor tissue, each about 1 cm. in diameter.

On section the masses are composed of dense fibrous tissue, in many places hyaline, covered with a fringe of sarcomatous tissue of the type of giant-cell sarcoma. The giant-cells are of the epulis type. There are a few trabeculae of bone which are separated by spindle tumor cells and are undergoing absorption. In several places the dense fibrous tissue is infiltrated by strands of tumor tissue in which the cells are spindle in form, with slightly hyperchromatic nuclei, but without admixture of giant-cells.

In the absence of full data regarding the anatomy of the tumor and its clinical course, it is impossible to give any positive opinion of the clinical malignancy of the case. The giant-cell areas belong in a group which generally pursue a benign course. The spindle-cell areas seem to possess greater growth capacity.

X-ray examination, November 11, 1914, showed an attempt at formation of a new joint; shaft of femur resting on the outer articular surface of the tibia. Over the inner articular, to correspond with the inner condyle, is new bone formation, making a contour of a fairly good joint; no ankylosis between femur and tibia. Lateral view shows new bone formation, anterior to the patella; appears to be some ankylosis with the patella; no evidence of metastasis.

A few days after the exploratory operation the patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus, and the doses were carried up to the point of giving a severe reaction. The toxins

were begun on November 11, one minim, and increased daily by $\frac{1}{2}$ minim, until December 27 when $8\frac{1}{2}$ minims (the highest dose) was reached, which produced a temperature of 104° . After this, a short interval of one week's rest was given; the toxins were then resumed, and kept up for one year with occasional brief periods of rest, seventy-three injections in all being given.

On December 2, 1915, Dr. Gibney reported that there was no deformity; the limb was straight with little, if any, motion. Two days later, December 4, the patient was discharged from the Ruptured and Crippled Hospital, wearing a brace on the right leg.

Inasmuch as the sinus had failed to heal the patient was given an anæsthetic and through-and-through drainage was established; curettings carefully examined by Dr. Ewing failed to show any evidence of malignancy. Rubber tubes were inserted and kept in for a number of months.

Patient was readmitted to the Ruptured and Crippled Hospital on March 7, 1916, for infection of old sinus. Just before admission, she developed pain and slight fever. Examination revealed what was apparently an inflammatory enlargement of the knee with a boggy swelling of the popliteal region. These symptoms continued and later fluctuation developed. In March, under local anæsthesia, an incision was made in the popliteal opening and a small abscess was found which apparently communicated with the old sinuses. One of these was opened and curetted and both openings were drained. Examination of curettings again failed to show evidence of malignancy. She was shortly treated with "Dakin's fluid" and rapid healing followed. The toxin treatment was resumed for a brief period and the patient has remained in good health ever since, upwards of two years since beginning of treatment; has gained 35 pounds in weight.

NOTE.—She is in good health, March 1, 1917, and walks with a brace.

EXTENSIVE SARCOMA OF THE UPPER END OF THE TIBIA INVOLVING THE FIBULA: CONSERVATIVE TREATMENT (TOXINS AND RADIUM): LEG SAVED

DR. WILLIAM B. COLEY also presented a young woman, seventeen years of age, who was admitted to the Hospital for Ruptured and Crippled on July 22, 1915, with a history of having first noticed trouble in the upper part of the right leg, just below the knee-joint, six months prior to her admission. This consisted of a small swelling on the inner side of the upper portion of the right tibia, slight amount of pain, increasing disability, and moderate loss of weight; no enlargement of glands in the groin. At the time of her admission to the hospital she presented a symmetrical enlargement of the whole upper portion of the

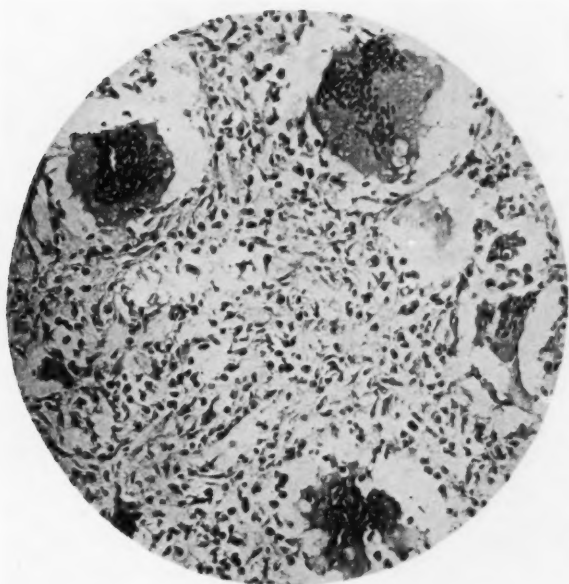


FIG. 4.—Fibrosarcoma of tibia containing giant scavenger (foreign body) cells. (Photomicrograph, high power, Barrie.)

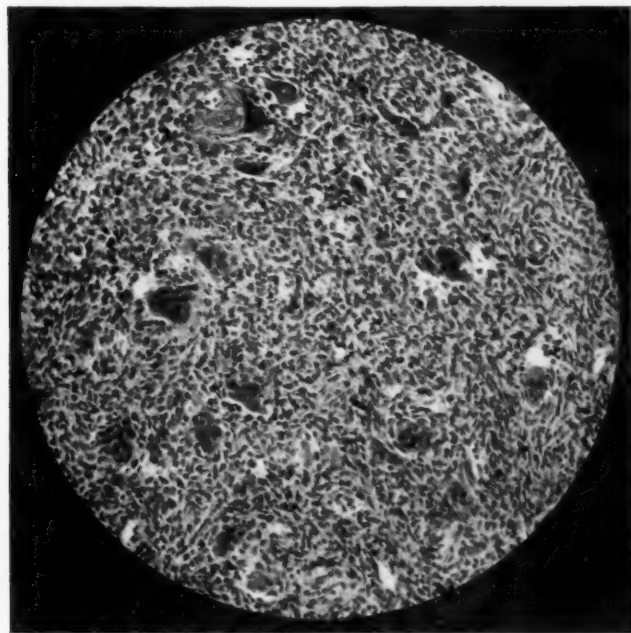


FIG. 5.—Central sarcoma of tibia, giant-celled (epulis type). Recovery under toxin treatment. Well one year. (Ewing.)

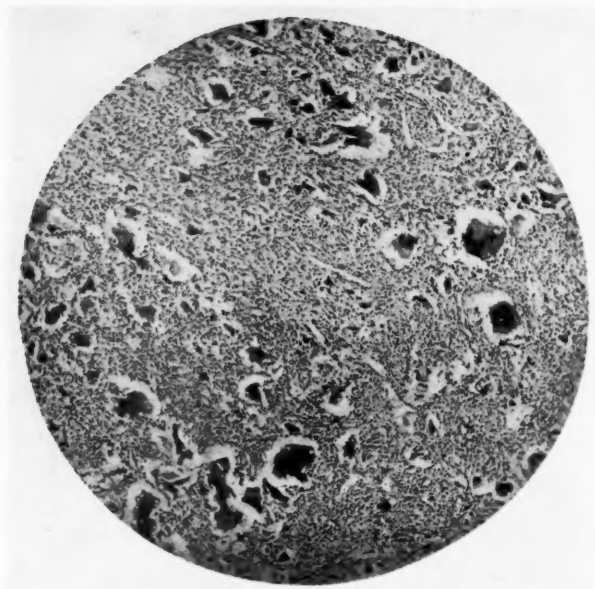


FIG. 6.—Fibrosarcoma of tibia, containing numerous giant scavenger (foreign body) cells. (Photomicrograph x80, Barrie.)



FIG. 7.—July 23, 1915. Before treatment.



FIG. 8.—July 23, 1915. Before treatment.



FIG. 9.—November 2, 1916. One and one-half years after treatment. Plaster cast obscures outline.



EXTENSIVE SARCOMA OF UPPER END OF TIBIA

right leg, most marked below the patella. The limb could be flexed to about a right angle; no muscular spasm. Over the inner portion, the tumor was extremely soft on palpation, having the "feel" of semi-fluctuation.

Measurements.—Right, $11\frac{1}{2}$, 12, $12\frac{3}{4}$, $11\frac{3}{4}$; left, $11\frac{1}{2}$, $11\frac{5}{8}$, $11\frac{1}{2}$, $10\frac{3}{4}$.

X-ray showed a tumor involving the entire upper extremity of the tibia, the bony structure of which was practically destroyed except on the outer and upper aspect; other bones not affected. The disease was so extensive that amputation was strongly advised, but refused by the patient. In view of the successful results obtained with the toxins in the case of sarcoma detailed above, conservative treatment was advised in the present case, *i.e.*, curetting for a microscopical section, to be followed by toxin treatment. In this opinion Dr. Gibney concurred.

On August 2, 1915, a four-inch vertical incision was made below the knee. The tumor was curetted out, and found to involve the whole upper part of the tibia for a distance of four inches, and nearly the same length of fibula, with the exception of the outer wall; a thin layer of cartilage which was perforated in curetting was all that was left of the upper end of tibia. The wound was packed with gauze, and a roller bandage tightly applied and the limb put up in plaster of Paris before removing the tourniquet. Pathological examination was made by Dr. F. M. Jeffries (pathologist to Hospital for Ruptured and Crippled), who reported the tumor to be "giant-celled sarcoma—melanotic."

Dr. James Ewing also examined a section microscopically and reported: "Tissue is composed of typical giant-cell sarcoma of epulis type and of very moderate malignancy."

A third examination was made by Dr. George Barrie, of the Post-Graduate Hospital, who pronounced it "fibrosarcoma with giant-cells." The clinical history of rapid development and extensive involvement furnish sufficient evidence of the malignant nature of the tumor. Blood examination, August 10, 1915; red blood-cells, 4,700,000; hæmoglobin, 85 per cent.

Four days after curetting, the patient was put upon small doses of the mixed toxins of erysipelas and bacillus prodigiosus (no other treatment). The initial dose, $\frac{1}{2}$ minim, was increased daily, by $\frac{1}{2}$ minim, until a decided reaction temperature of 102° - 103° - 104° was obtained, after which, four injections a week were given.

The cavity gradually filled up with healthy granulations, and a note by Dr. V. P. Gibney, dated November 15, 1915, states: "Open sinus over inner head of tibia; no infiltration about knee. Small range of

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motion allowed, not fully tested. General condition excellent. On high road to recovery."

The leg and thigh were kept in a plaster splint and the sinus treated through a window in the splint. By December 1, the sinus had closed and there was no evidence of any tumor either by physical or X-ray examination. X-ray pictures were taken regularly every two weeks. Marked new formation of bone could be noticed in the upper end of the tibia, which was completely destroyed at the time of operation. The patient also gained in weight and strength. On December 27, 1915, she was shown before the Alumni Association of the Hospital for Ruptured and Crippled, at which time there was no evidence of any lesion present.

On January 9, 1916, the patient suffered from an attack of grippe and the toxin treatment was discontinued for two weeks. On January 26, the plaster case was removed and a recurrent tumor the size of a pullet's egg was found at the upper and inner end of the right tibia, at the site of the old sinus. An X-ray picture also showed the growth. The toxin treatment was again administered, and given both locally and systemically. The tumor diminished somewhat in size but did not disappear, and on March 3, 1916, a portion of the growth about the size of a hen's egg was removed by curette and the wound was packed. A microscopical examination of the mass removed was made by Dr. Ewing, who pronounced it "giant-cell sarcoma." Blood examination, March 5, 1916: Red blood-cells, 4,856,000; white blood-cells, 7,800; hæmoglobin, 82 per cent.

On March 10, 100 mg. of radium emanations were applied over the site of the tumor, and allowed to remain for twenty-three hours. The toxin treatment also was resumed, the doses being increased every other day up to the point of producing a temperature of 102° – 103° . The soft tumor-like area slowly increased in size, and by April 1 it measured 1 by $\frac{3}{4}$ inch; it was non-fluctuating. On April 8, 150 mg. of radium emanations were applied to the lower and ulcerated portion of the swelling, and kept on for seven hours, after which it was moved two inches higher over the articular surface of the tibia. On July 22, 240 mg. of radium were applied over the same site, for fourteen hours. Her local condition continued to improve, the sinus gradually healed, and the patient's general condition returned to normal. The toxins were continued during the summer with occasional intervals of rest.

On October 4, 1916, when she left the hospital, there was no sign of a tumor and she was in good physical condition.

At present, November 22, 1916, there are no signs of local or general recurrence, and she has gained twenty-four pounds in weight.

NOTE.—She remains well March 1, 1917, and is walking with a brace.

SARCOMA OF THE LONG BONES

CONSERVATIVE TREATMENT OF SARCOMA OF THE LONG BONES

DR. COLEY also presented four other patients who had recovered from sarcoma of the long bones under conservative treatment.

The first case dated from January, 1910—a very rapidly-growing spindle- and round-celled sarcoma of the humerus with extensive involvement of the shaft. Patient, a man, was referred by Dr. Finney, of Baltimore, as an inoperable case. Toxins given for six months (no other treatment); apparent complete disappearance of tumor, reunion of bone. Recurrence a few months later near the shoulder; amputation. Several months later a large mass appeared in the pectoral region beneath the muscle, the size of two fists; incomplete removal followed by toxins for long period. Complete recovery; patient shown at meeting.

Dr. Coley said that his case would be remarkable no matter what type of growth it presented, since, as far as he had been able to ascertain, there has been no sarcoma of the humerus that had recovered and remained well for a period of three years after amputation or any other method of treatment. Several pathologists, including Dr. Bloodgood and Dr. Ewing, examined the tumor in this case, and all pronounced it of highly malignant type; spindle- and round-celled, no giant-cells.

The speaker also referred to the case reported by Dr. J. Bapst Blake of Boston, of sarcoma of the upper end of the humerus with involvement of the scapula, which after an incomplete operation (curetting) recovered under prolonged toxin treatment, and was in good health twelve years afterwards.

Dr. J. H. Gibbon, of Philadelphia, also reported a case of periosteal round-celled sarcoma of the humerus, in which, the patient having refused amputation, Coley's toxins and the X-ray were resorted to, with the result that the tumor completely disappeared, and the patient was in good health six years later. (Two additional cases of sarcoma of humerus have been successfully treated with the toxins, and arms saved.)

DR. COLEY presented also three other patients. One, a woman, twenty-seven years of age, with periosteal sarcoma of the femur, who had recovered under the mixed toxin treatment and had remained well for four years; the second, a woman, seventeen years of age, with a myeloid sarcoma of the lower end of the tibia, who had recovered under the toxin treatment and had remained well for eleven years; in this case X-rays were used in conjunction with the toxins; the third, also a woman, twenty-six years of age, who had a giant-celled central sarcoma of the radius, and after curetting had been subjected to the toxin treatment and had remained well for eight and one-half years.

These had been reported by him in his earlier reports on the subject and were now presented to show the final results.

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CALCAREOUS PLAQUES IN THE ABDOMINAL AORTA CAUSING A STENOSIS OF THE PYLORUS

DR. H. H. M. LYLE presented a man, aged forty-five years, who entered the St. Luke's Surgical Service October 27, 1916, having suffered from stomach trouble for fifteen years. He gave a typical history of pyloric stenosis, dilated stomach, and motor insufficiency. Chemical examination of stomach contents: Total acidity 46, free acidity 14, combined 18, no blood. Wassermann negative. Red blood-cells 5,000,000; hæmoglobin 95 per cent. The radiological findings showed a high grade of pyloric stenosis with a corresponding dilatation of the stomach. The abdominal examination revealed in the epigastrium, just to the right of the spinal column, a hard fusiform pulsating tumor. Its long axis was vertical, there was no movement with respiration, but the tumor could be moved slightly from side to side.

On the evening previous to the admission of the patient to the hospital, Dr. Lyle had heard Dr. Eliot, of the Society, report a case of "plaques" in the portal vein mistaken for a gall-bladder full of stones. With this fresh in mind the patient was sent to the operating room with the tentative diagnosis of dilatation of the stomach, pyloric stenosis, abdominal aortitis. On opening the abdomen the stomach was found to descend into the pelvis, the pylorus was represented by a fine tube four inches long and less than the diameter of a lead pencil. There were no signs of ulcer, the extended pyloric tube being perfectly soft. There were no adhesions or enlarged glands. The gall-bladder was normal. The thickened calcareous aorta lay to the right of the spinal column, and passing over it was the extended pyloric tube. A non-loop gastro-enterostomy was performed. The patient made an uneventful recovery.

Dr. Lyle said he was at a loss to explain the tube-like pylorus, because, although the lumen of the tube was very small, it was soft and supple and showed no evidences of connective-tissue changes. In this case the lesser curvature near the pylorus was fixed well up in the abdomen, while the greater curvature was in the pelvis. Could the stretching of the dilated stomach across the rigid aorta have caused the condition?

HOURLY-GLASS DEFORMITY OF STOMACH

DR. FREDERIC T. VAN BUREN presented a woman, aged forty-three years, who entered Roosevelt Hospital on Dr. Dowd's service, April 9, 1916, suffering from symptoms pointing to perforation of a gastric ulcer, with an onset three days previous to admission.

Immediate operation under ether anæsthesia disclosed a perforation of the pylorus about $\frac{1}{2}$ cm. in diameter with firm adhesions binding together the gall-bladder, stomach, duodenum, transverse colon and

HOURLASS DEFORMITY OF STOMACH

omentum. These adhesions walled off from the general peritoneal cavity an abscess containing about three ounces of pus with a colon bacillus odor. In separating the adhesions to mobilize the pylorus for purposes of repair, the right lumbar gutter was exposed and found to be partially filled with cloudy fluid. The perforation was repaired by a purse-string suture of plain catgut, reinforced by three interrupted transverse sutures, drawing the anterior wall of duodenum and pylorus together, and further defended by suturing fat tabs from the greater and lesser omenta together across the duodenopyloric junction. The wound was closed by layer sutures without drainage. Her recovery was complicated by infection of the superficial part of the wound. Healing took place by granulation, and she left the hospital on May 23, 1916, six weeks after operation, with a healed wound and no sign of hernia. Her health improved and she was very comfortable for ten weeks after the operation. Then she began to have a feeling of fulness in the upper abdomen and considerable eructations of gas and passed much flatus which relieved her. This distress came on in the evenings and she would feel pretty well in the mornings. Ten days before her second admission to the hospital, she vomited in the late afternoon, something she had eaten early that morning. A week later she vomited again. The vomitus was sour and bitter, but no blood was noticed in the vomitus, and no tarry stools were passed.

On July 11, three months after first operation, she entered Roosevelt Hospital on the service of Dr. Hotchkiss. At that time skiagraph of the stomach (which could not be taken before her first operation) showed what appeared to be an hour-glass deformity of the stomach with retention of bismuth in the pyloric pouch, after six hours, but no retention in the cardiac pouch. The deformity had not been suspected at the first operation and no effort had been made, at that time, to inspect the entire organ for fear of spreading the contents of the abscess around the perforation. With the evidence of retention and the skiagraphic appearances, a diagnosis of hour-glass stomach with pyloric obstruction by adhesions was made, and operation performed on July 13.

An incision mesial to the scar of the first was made through the upper right rectus, and adhesions between the viscera and the anterior wall separated with great difficulty, sufficiently to show the gall-bladder firmly adherent to omentum and transverse colon, across the duodenum. At this time only the pyloric portion of the stomach was visible, and very firm, broad and vascular adhesions between the stomach and under surface of the liver had to be separated before the cardiac portion of the stomach could be brought into view. Then it was evident that a cardiac and pyloric pouch, each of ample size, were separated by an

isthmus about 3 cm. in width and length. This narrowed portion of the stomach presented no appearance of cicatrization or thickening to sight or touch, but persisted in size and shape while under inspection and apparently was a real deformity and not a spasm. Under the present condition of the parts a double posterior gastro-enterostomy was believed to be more feasible than a combination of gastrogastrostomy with gastro-enterostomy, and the former operation was done, uniting the jejunum as near as possible to the duodenojejunal angle, with the cardiac pouch; and uniting the pyloric pouch with the jejunum about two inches lower down. Both anastomoses were made through the same opening in the transverse mesocolon and chromic catgut was employed for the mucous suture and Pagenstecher for the seromuscular suture. The mesocolon was stitched to the borders of the anastomoses by several interrupted catgut sutures. The abdominal wound was closed in layers without drainage, and the patient made an uncomplicated recovery, leaving the hospital August 20, 5 weeks after second operation.

A skiagraph taken November 17, 1916, three months after her second operation, shows rapid emptying of the stomach, both cardiac and pyloric pouches, through the gastro-enterostomy openings. She has no symptoms of indigestion, and eats anything she pleases, only taking care to avoid known indigestible foods.

DR. W. S. SCHLEY said that in hour-glass stomach the tendency to recurrence after plastic operation is very great, even after some years have elapsed. Organization of exudate and plastic adhesion after inflammation or operation, with resulting contraction, seems particularly prone to occur with the stomach and upper duodenum although the process is often a very slow one. Two years is a little bit short for final judgment. He had shown one or two cases some time ago before this Society that recurred after a period of five years, after apparently complete restoration of the stomach contour in every particular. He was surprised to find a complete recurrence after five years, the patient having had excellent health and forty-five pounds gain in weight.

He believed that gastro-enterostomy should be a part of practically all operations for hour-glass contracture of the stomach of severe degree, and that operations that do not contemplate its inclusion in the reparative work for this condition are incomplete in certainly 75 per cent. of cases.

DR. CHARLES H. PECK said that some of the best results he had had in cases of hour-glass stomach had been with a plastic operation of the type of Finney's pyloroplasty. It is especially suited to cases where both cardiac and pyloric pouches are of fair size and the line of the lesser curvature is nearly normal. Dr. Kammerer first suggested this

COMPOUND FRACTURE OF THE LOWER JAW

procedure for hour-glass stomach and he first saw it used by Dr. Dowd. He had followed two of these cases for nearly three years and the result has been satisfactory, both have gained weight and have been free from obstructive symptoms. In cases in which the pouches are nearly equal and of good size, he believed this operation to be an excellent one.

DR. FREDERIC KAMMERER said that in one instance in which he had applied the Finney method for relieving an hour-glass constricture, the results were very good for six years, but had to be operated on after that time by another surgeon for a recurrence.

COMPOUND FRACTURE OF THE LOWER JAW

DR. ARTHUR L. FISK presented a man who on Wednesday, November 8, sustained a double compound fracture of the lower jaw. One fracture was between the canine and second incisor teeth on the right side, this ran downward and inward towards the symphysis; and the other was between the second and third molar teeth on the left side, this fracture ran downward and backward towards the angle of the jaw. Both fractures extended completely through the body of the bone and both were compounded into the mouth. The fragment of the jaw between the two fractures was displaced downward and outward. The patient came to him November 9, sixteen hours after the injury—his pain was intense; he was unable to articulate easily or well, or to swallow; the mouth was open, from which saliva was running and the jaw was supported by his hands. He referred the case to Dr. H. S. Vaughan, who used a method and splint, which he has devised, that so perfectly reduced the fracture and held the fragments so well together after reduction that relief was immediate. There has not been any infection, infiltration of the tissues or abscess formation, so that the wounds have practically healed by first intention. These results are so unusual and the method in such contrast to all former treatments of fractures of the jaw, that at his request Dr. Vaughan had come this evening, to demonstrate this method to the Society.

DR. HAROLD S. VAUGHAN said that as all fractures of the mandible or inferior maxilla are compound and subject to mouth infection, when the line of fracture is in relation to the teeth, early and positive immobilization is necessary to prevent infected saliva from being sucked into the line of fracture, which results in an osteomyelitis with prolonged suppuration before final union is obtained.

During the past eight years he had made use of the orthodontia clamp bands fitted to the molars or bicuspid on each side of the maxilla and mandible, connected with an arch wire ligated to all the anterior teeth. The two jaws are then immobilized by wiring together the larger arch wires.

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In the case that Dr. Fisk has presented there was a line of fracture on the right side of the mandible between the lateral incisor and canine, and on the left side posterior to the second molar (Figs. 10 and 11). A non-erupted impacted third molar is shown by the radiograph in this line of fracture. This tooth was extracted before complete reduction of the fracture could be obtained. This splint is easily made.

He saw the patient at noon. First he made impressions of the two jaws, and from these plaster models were made (Figs. 12 and 13).

The model of the lower teeth showed the displacement of more than the width of a tooth between the right lateral incisor and canine. This model was sawed through at this point and corrected to the original condition, using the upper model as a guide to the correct occlusion of the teeth.

Orthodontia clamp bands were then fitted to the first molars on each model and the arch wires adjusted accurately to the necks of the teeth. The bands were then clamped to the patient's teeth; the arches adjusted—gradually bringing the bone into position. The jaws were then immobilized by wiring the arch wires together (Figs. 13 and 14).

Sufficient liquid nourishment can be drawn between the teeth and behind the posterior teeth, or the mouth can be opened slightly by fitting a piece of rubber between the molars, on each side, before wiring.

Where there are no complications the appliance is worn four to six weeks.

DR. NATHANIEL GREEN said that some six or seven years ago he had quite a number of fractured jaws to treat at the City Hospital. At that time he took impressions of them and made tin splints cast from block tin, and then screwed them to the teeth with little screws like a watch-maker's. But they spread the teeth apart. He did not get a very good approximation of the fragments; but it helped materially with these cases. The trouble with that method was that it took about two days to make the whole thing. This splint of Dr. Vaughan's is very quick to apply and very neat, and it does what his did not do after it was put on—it puts a sort of turnbuckle on the whole jaw and brings the fragments close together instead of simply holding them—it squeezes them close together.

DR. EDWARD M. FOOTE said that the patient shown had excellent teeth in both jaws. Experience gained at the City Hospital where fractures of the lower jaw are common, convinced him that it is a most important thing for the patient to have good teeth. If both sets of teeth are intact, it is rare that a bad result follows fracture. The apparatus shown is very neat, and will undoubtedly shorten the period of recovery. But the



FIG. 10.—Shows fracture behind left second molar with impacted non-erupted third molar in the line of fracture.

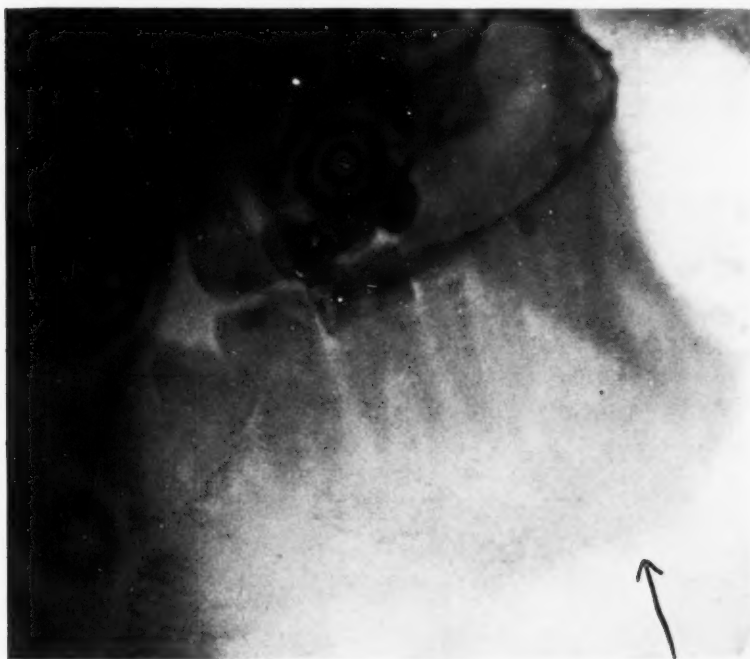


FIG. 11.—Shows line of fracture between right canine and lateral incisor after adjustment of splint.



FIG. 12.—Shows model of lower teeth before correction. Note wide separation right lateral incisor and canine.

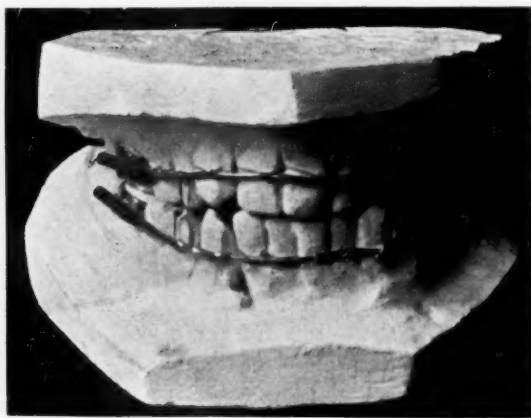


FIG. 13.—Shows models of both jaws with splint in position, after correction of lower model and adjustment to upper.

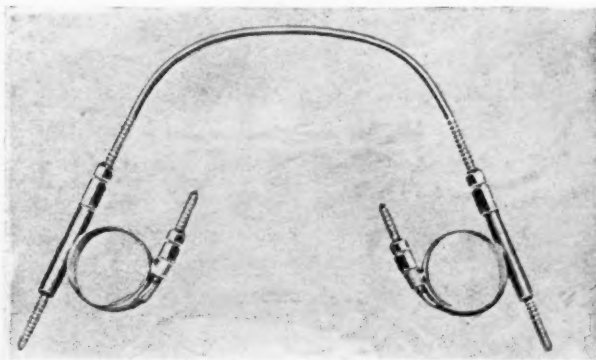


FIG. 14.—Shows adjustable clamp bands with tubes to receive the arch wires.

ADENOFIBROMATA OF BOTH BREASTS

difficult cases are those in which the teeth are faulty or do not match. These are the ones to put any treatment to the test.

DR. ARTHUR L. FISK said that in this patient the teeth did not match well to begin with, so that at the outset the case was not easy. Further, the fracture between the second and the third molar teeth made an additional complication which necessitated the extraction of the third molar tooth. The application of the splint gave almost immediate relief of the pain, because it held the fragments so accurately and firmly in position.

When the man first came to see him, he was a pathetic object; suffering excruciating pain; unable to speak or to swallow; on the following morning, the change was remarkable. The man sat reading the morning paper; he greeted him with a smile; he said that he had had a good night's rest, and that he had had something to eat. A great transformation in less than twenty-four hours!

There had not been any foulness of the mouth, as usually occurs in these cases—the compound wounds have been clean, so that they have healed by first intention, because of the accurate and firm coaptation of the fragments: and there has been no infection of the soft tissues with the formation of abscesses.

The splint being wholly within the mouth is therefore completely out of sight; it causes little if any inconvenience and permits the patient to resume work in a short time.

It is the neatest and best apparatus for treatment of fractures of the jaw thus far devised.

ISCHÆMIC CONTRACTION OF FOREARM

DR. ROYAL WHITMAN presented a child five years of age, illustrating the effect of treatment of typical ischæmic contraction. He said that the patient was one of several that he had hoped to show at the last meeting, and the only one in which the contraction had not been complicated by sloughing of the tissues of the forearm. The contraction followed the treatment of fracture of the right forearm in February, 1915. The treatment had been by the Jones method and practically perfect functional recovery had been attained.

ADENOFIBROMATA OF BOTH BREASTS

DR. PARKER SYMS presented a woman, aged twenty-four years, who was admitted to Lebanon Hospital, October 27, 1916. Three years ago she first noticed a swelling in her left breast. This has increased in size from that of a pea to that of an egg; has had no pain or tenderness.

On examination several smooth, hard, movable masses were felt in the left breast in the upper quadrant. These masses appeared to

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be distinct and freely movable and there was no evidence of mastitis. One similar mass was found in the right breast below and to the right of the nipple. This was also hard, smooth, round and freely movable.

Operation under ether anaesthesia by means of Thomas plastic method. Each breast was turned over and the tumors were removed through the posterior surface of the breast. The masses were found to be distinctly encapsulated, and each one could be easily enucleated. The microscopic examination showed these tumors to be adenofibromata. A small piece of one breast was removed and examined, and showed no evidence of chronic cystic mastitis.

Dr. Syms showed this case because it illustrated the fact that these are true tumors in the sense that they are not part of a cystic mastitis; they are isolated and encapsulated, and can be thoroughly enucleated. Dr. Syms emphasized the fact that these true adenofibromata should be removed by the plastic operation; the chronic cystic mastitis cases requiring, in his opinion, an entirely different method of treatment.

CHRONIC CYSTIC MASTITIS

DR. PARKER SYMS presented a woman, aged fifty-six years, who was admitted to Lebanon Hospital November 14, 1916.

Five months ago (July, 1916), the patient noticed a small lump in her right breast. She also complained of some tenderness or pain in her right breast. The pain was transient, and only present when the patient was fatigued.

Examination.—There is a hard, irregular, not freely movable mass near the nipple of each breast. There is not much irregularity or evidence of change in the texture of other regions of the breast; the process seems fairly localized. These masses are very different from the adenofibromata of the patient just presented.

Clinical Diagnosis.—Chronic cystic mastitis with tumor-like masses.

Dr. Syms presents this patient because he feels that it illustrates some facts brought out in the paper he recently read before the Surgical Society on chronic cystic mastitis. At that time he pointed out the fact that these masses, the so-called tumors—the adenofibromata of chronic cystic mastitis, are not true tumors; they are not separate and distinct; they cannot be enucleated but can only be removed by cutting through breast tissue. They are not suitable for the plastic operation of Thomas.

PERINEAL PROSTATECTOMY FOR PROSTATIC HYPERTROPHY

DR. PARKER SYMS presented a man, aged sixty-three years, who was admitted to Lebanon Hospital, November 9, 1916. One year had acute retention of urine; had to be catheterized. Since that time has been

GUNSHOT WOUND OF THE PERIPHERAL NERVES

troubled with frequency of urination. At present he urinates every twenty or thirty minutes during the day and six or eight times at night.

The catheter can be passed with reasonable ease. Residual urine, ten ounces; urine clear and of fair specific gravity; prostate is found to be enlarged, two lateral lobes; it extends high up, doubtless projecting into the bladder.

Operation (November 15).—Perineal prostatectomy through median incision. The lobes were exposed to view and enucleated with little difficulty. November 17, the double drainage tube was removed; November 18, the patient has bladder control; November 19, patient urinates through urethra; November 22, patient holds his urine four to five hours; urinates freely through urethra.

Dr. Syms showed this patient to illustrate what can be accomplished by perineal prostatectomy. The patient was operated upon one week ago; he was able to be up and walking about two days after the operation; he had more or less bladder control after the tube was removed two days after operation; the operation was quickly performed; the patient lost little blood and suffered nothing from shock.

GUNSHOT WOUND OF THE PERIPHERAL NERVES

DR. HERMANN FISCHER read a paper with the above title, for which see page 56.

DR. KARL CONNELL remarked that the war now being waged presents a mass of nerve injury hitherto unapproached. During the first winter of the war when he was in France, the nerve cases were not sorted into special groups, but on a trip through Germany in March, 1915, he found these like other special injuries already assembled and grouped for more efficient treatment. Thus he came superficially in contact with many hundred of these cases. In considering the etiology of these lesions it was interesting to note that the nerve to be damaged need not lie directly in the path of the missile, but it suffices that the nerve lie in the zone of the intense radial hydrodynamic pressure produced by modern high power missiles. Thus nerves were seen the subject of paralyzing contusion, and subsequent traumatic neuroma, that lay a half centimetre or more outside the path of the bullet. The majority of the lesions, however, were from direct injury, by being clipped, pierced, severed or directly contused by missile, or pressed upon by retained foreign body, or by subsequent callus and scar.

In considering the primary treatment of nerve lesions produced under the conditions which obtain in this war; it is theoretical to advise that severed nerves shall be primarily sutured when the wounds are clean, for practically the fresh wounds are never clean. Such fine pro-

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cedure as nerve suture has not proved itself justifiable until the wounds of soft parts have entirely healed, thereby giving the surgeon a sterile field in which to operate. Then and only then can one in the average obtain successful nerve anastomosis. That at least is his own observation and the opinion of various workers with whom he came in contact, such as Bourchardt at Berlin, who had on his service at the Virchow Hospital up to April, 1915, some 300 nerve lesions of which 40 had been operated.

As to operation after the wound has declared itself clean by healing solidly, it was the general opinion in Germany that the earlier the nerve lesion is investigated by a competent surgeon the better. There were those who believed that one should wait from four to six months for spontaneous recovery. However, if the surgeon finds at operation no lesion to repair, no harm is done by careful inspection of the nerves. If on investigation scar only is found it usually suffices to loosen the nerve from cicatrix and to pack it round about with transplant of subcutaneous fat against further constriction. In every case the electric conductivity of the nerve should be tested through the scar or through the traumatic neuroma so commonly produced in these injuries, and if area of non-conduction be found that portion of the nerve or neuroma should be excised and the nerve ends sutured. By this method a considerable portion of a nerve cylinder may be rescued intact from entangling scar or neuroma. It is a long tedious task involving technical knowledge and surgical nicety to work out one of these lesions.

DR. H. H. LYLE said that he wished to emphasize Dr. Fischer's statement of the seriousness of injury to a peripheral nerve. Damage to an important peripheral nerve is an injury of extreme gravity.

Dr. Fischer, in his paper, has given us an able presentation of the operative side of the question. Dr. Lyle said that he wished to call attention to the importance of the physiological treatment of such wounds. Unrelieved, overstretched muscular tissue leads to fatty degeneration and consequent loss of contractility, and it is imperative, whether the nerve is divided or not, that the paralyzed muscles be relaxed and protected from strain by a suitable apparatus. This postural prophylaxis begins with the reception of the wound and continues after the operation until voluntary motion is restored. A strict adherence to this vital orthopædic principle aids in the diagnosis, hastens recovery, prevents many deformities, and diminishes the number of useless limbs.

Dr. Lyle said that in his article, "The Physiological Treatment of Bullet and Shell Wounds of the Peripheral Nerve Trunks" (*Surgery, Gynecology and Obstetrics*, February, 1916, p. 127), he had said that primary nerve suture is rarely indicated in war time. This statement

GUNSHOT WOUND OF THE PERIPHERAL NERVES

was made before Dr. Lyle had any experience with the Carrel-Dakin method of treating wounds. During the spring and summer he had personal opportunity of applying this method. The brilliant results obtained would now lead him to modify the above statement.

DR. WM. O'NEILL SHERMAN, of Pittsburgh, by invitation, said that the point raised by Dr. Lyle was a very important one. He saw possibly fifty or sixty nerve suture cases in Paris. These operations were done, many of them, at the end of three, four, five, six and nine months and the end-results were not very satisfactory. Now, of course, the duration of time that exists from the time of the injury until the operation is an important factor; degeneration has taken place in the delayed cases and it is impossible to secure perfect functional results. He had seen enough of the Carrel method to be absolutely sure that the statement that these wounds can be sterilized is based upon sound reasoning; thousands of them have been sterilized. There is not sufficient evidence to say that the nerve wound should be sutured immediately and the wound sterilized, or whether the wound should be sutured after the sterilization, and the nerve resutured at a later date. The French surgeons had the same question up in reference to the use of plates, whether or not it would be wise to immediately plate fractures, or whether it would be best to sterilize the wound and plate later. At the present time, there are not sufficient statistics or evidence to draw any definite conclusions, whether the immediate suture of either nerve or bone is the best thing to do or whether or not it would be better to wait until after sterilization to apply the suture. He had one case in mind that he saw in Dr. Lyle's service; a very extensive shell wound of the buttock—a frightful wound, exposing the sciatic nerve at the notch. Under former methods of treatment that patient would certainly never have recovered within four to five months, but in six weeks the wound was united.

In speaking of Carrel's method, it is very unfortunate that many in the profession are very skeptical about it. They will not accept it until they have opportunity to work it out themselves; certainly it has been demonstrated in France by the best men there, that it is far in advance of any other method of treatment. The results secured in France should convince any surgeon and he should immediately accept it without the skepticism and criticism that is heard throughout the profession.

DR. TAYLOR said that it is important to save all possible nerve length for suture. It has been his experience in dealing with these cases to find that the main trunk of the nerve will come well down into the bulb before the nerve fibres begin to turn around, and the dividing of the nerve transversely at its proximal end wastes valuable material. If one starts somewhere near the tip of the bulb and makes a series of

transverse sections until such time as good nerve bundles are found in a group in the centre, one may oftentimes save an appreciable length of nerve, which is very important in getting good apposition. One can then proceed to remove the bulb all around the periphery until the nerve trunk is free with which to do end-to-end suture.

With regard to neuroplasty, the thing which is spoken of in all the books, and which is derived from the tendinoplasty, is an exceedingly illogical procedure. For instance, if one turns down a segment of nerve in order to get a bridge, it is a thoroughly established fact that the moment you divide any nerve fibre from its central end you get degeneration, and it seemed to him exceedingly illogical when one is already dealing with a damaged nerve, to proceed to do further damage to the central part of the nerve. Therefore this method of procedure cannot be too strongly condemned. One certainly never can succeed in properly bridging a gap by this method.

The difficulty in using calf's arteries is to have a proper series of sizes always in one's pocket when one is dealing with nerve cases. It is a difficult thing to have a sufficiently large number of arteries so that one can fit the nerve with the artery. The artery must be comparatively near in size to the nerve that is to be put in it.

A considerable amount of experimental work was brought forward by Dr. Dean Lewis in Chicago in which he seems to prove that fascia taken from the individual and made into a tube, with the smooth side inside to act as the inner lining of the tube, would on the whole give the best method of bridging; that it was not necessary to fill that fascial tube with agar or any other substance, that the serum which would flow in there would act very well as framework down which the regenerating nerve fibres would find their way perfectly well; that fibrous tissue implanted in this way always led to scar tissue and thickening, he disproved by a series of sections in which after a few months the fibrous tube which he had used had melted in with the new nerve sheath so that you could scarcely tell at what portion of the nerve trunk the bridging had been done. It seems, therefore, since tissues taken from the patient himself invariably heal in that patient with less reaction, that this method would offer a more feasible manner of bridging the nerves.

DR. GEORGE WOOLSEY remarked that Dr. Fischer mentioned the care required not to rotate the nerve in nerve suture. This is a wise precaution, but is it necessary? One can rotate the nerve through 180 degrees and suture with the same results as when one sutures it as nearly as possible in its normal position. It is not possible to get one nerve fibre opposite another nerve fibre in suturing. At least it is a matter of

CARBUNCLE OF THE NECK

luck. As Kennedy has shown, the nerve centres are readily re-educated to the changes in the path of nerve impulses and on this depends the possibility of nerve anastomosis.

The channels along which certain nerve fibres pass to certain muscles, is another question. He was not thoroughly acquainted with Stoffel's work. It has previously been held that the fibres which pass into a branch of a nerve are not collected together, that they are separated in the nerve itself until shortly before that branch is given off. If it were not the group of muscles supplied by a branch would be liable to complete paralysis in nerve anastomosis. In the peroneal nerve, for instance, we could never make the nerve plastics that we do. We could never make plastic operations on nerves without the danger of completely paralyzing groups of muscles, because we would be liable to cut all the fibres which pass to those muscles.

As he understood the reference, Stoffel holds that the fibres pass to the tibialis anticus, for instance, on the side of peroneal nerve next to the biceps muscle, etc. It seems to him that there must be some error there for experience in plastic nerve operations and nerve anastomoses has been quite incompatible with it. We don't get such complete paralysis of muscle groups by the partial division of the nerve trunk without regard to the part of the nerve divided.

DR. TAYLOR said that Dr. Woolsey's remarks should not go entirely without further discussion. Bundles of nerve fibres going to individual muscle bellies run together for a considerable distance in the nerve trunk before separating as a branch. That is proved by starting with a branch that runs to muscle and separating it up almost to the origin of the whole trunk which is done readily and without cutting across fibres. Stimulation of such nerve bundles will cause contractions in the muscle to which that branch goes.

In other words, Stoffel's point is well taken, and while it is impossible to divide a nerve and then to get individual axis-cylinders approximating to their corresponding fellows in the other end of the nerve, it does seem that we ought to attempt to do that just as much as we can.

Stated Meeting, held December 13, 1916

The President, DR. CHARLES N. DOWD, in the Chair

CARBUNCLE OF THE NECK: SKIN GRAFTING

DR. ARTHUR S. VOSBURGH, to illustrate the method for skin grafting, which was presented before the Society and was recorded in volume v, page 891 of the ANNALS OF SURGERY, presented a man,

aged fifty-three years, who was admitted to the surgical ward of Bellevue Hospital, September 6, 1916, with carbuncle which covered the entire dorsum of his neck.

When Dr. Vosburgh came on service on October 1, this man was in the ward with a sloughing area, the extent of which can be seen in Fig. 1. He applied straps to the area and after a period of strapping lasting for a week or two, he had the appearance seen in Fig. 2.

The skin had been so undermined by previous incisions that as the wound was strapped the skin on the left side began to turn in so that skin was growing on skin. This flap he dissected out and straightened it out so that it covered a part of the neck, where it was held in place by means of a suture which led over to the opposite side of the neck. This narrowed his wound to a considerable degree.

On October 14, he skin-grafted according to the Thiersch method by grafts removed from the thigh. These were transferred to a piece of rubber tissue approximately the size of the area to be grafted, the grafts being placed on the tissue with the raw surfaces uppermost. The grafts were then placed over the granulating area, and the rubber tissue removed. Very slight shifting was necessary to bring them into their proper position. The grafts were held in place by adhesive plaster laid directly on them, fixed on either side to the firm skin of the neck. This method of applying adhesive plaster directly to the Thiersch graft has been tried by a number of men who have reported that it has met at their hands with considerable success.

There is just one word of caution, or, rather, one very essential part of the procedure—that the operator himself should do the first dressing of the grafts. On removal of the adhesive straps, it will often be thought that the grafts have failed; but if the wound is allowed to dry a little, and is then viewed by oblique illumination, it will be seen that the areas which look red and raw are actually covered by epithelium.

Notwithstanding the extensive area presented in this case one attempt was sufficient to cover it with possibly 90 per cent. of "takes." The adhesive straps used were sterilized in the alcohol flame and interrupted but very slightly. There was a considerable discharge between the straps, and the entire dressing with the straps was removed on the sixth day. Ninety per cent. of the area had taken. The very small areas where the grafts had failed were in the neighborhood of the undermined skin. These closed over very rapidly under a continuation of the strapping of the wound with adhesive plaster.

The preliminary treatment of this neck, previous to operation, was by compression strapping with adhesive plaster. No antiseptics were



FIG. 1.—Before grafting.



FIG. 2.—The grafts applied.



FIG. 3.—The result.

CARBUNCLE OF THE NECK

used; no cleansing of the wound at any time during these dressings except on the surrounding skin.

The lack of acceptance of this very simple method of dressing the graft may be due to the fact that operators think the graft has failed when in reality layers of epithelium from the graft have become adherent and viable. He had used the same method on burns of the back, shoulders, arms, and especially in parts of the body where, during their recovery from ether, the *patient* might dislodge the dressing. He had had uniform good results if autogenous grafts were used.

DR. MATHEWS said that he had been using the method of Dr. Vosburgh ever since he first demonstrated it to the Society and with better results than with any method previously employed. He had not liked the method of open-air treatment of grafts for the first few days, because they are likely to be raised from the surface of the wound by accumulations of serum and blood and secretions are likely to be retained by scab formation. The prevention of slipping of the grafts by this method has made it especially useful in the case of children and in adults on those parts of the body, such as the back of the neck, where there is such difficulty in keeping the parts at rest.

DR. W. S. SCHLEY thought that Dr. Vosburgh's case illustrated the wisdom of radical excision in a carbuncle of size; both for speedy cure of sepsis and quickness of repair. The danger in many cases is extension to the muscular planes of the neck. He remembered showing a case before the surgical section some time ago in which it was necessary to excise from the superior curved line of the occipital bone to the base of the neck. This case was in extremely bad shape, but he turned around and had a very excellent convalescence. He refused to have a skin graft and healed by granulation. The enormous area filled in completely and with no contractures. He went back to his trade, which was that of piano maker, and had perfect freedom and use of his neck.

The method of skin grafting that Dr. Vosburgh speaks of is certainly excellent. That is, putting very little dressing over the grafts. We have been accustomed to use grafts laid on rubber tissue and putting on as shingles, in layers overlapping directly and not disturbing the wound edges to any great extent, though, just enough to prevent sliding. He thought rubber tissue over the graft has worked better than the adhesive plaster direct in the grafting. It allows any drainage that may occur exit between the grafts. Grafting on a surface freed of excessive granulation certainly is very necessary to the adhesive quality of the graft. Adhesive plaster is applied directly over the rubber tissue and a light gauze dressing over this.

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RESECTION OF CÆCUM AND ASCENDING COLON

DR. ARTHUR S. VOSBURGH presented a man, aged twenty-six, who was admitted to the hospital on June 18, 1915, with the following history: He was born with a rupture, which, during childhood and early adult life, gave him no discomfort, but which, for some time past, has increased in size, until it is now as large as a grape fruit. He states that when he stands the mass descends into scrotum, but that when he lies down it reduces itself. He complained of no pain. Upon examination the right external ring was found to admit more than four fingers, a large mass was felt in the right inguinal region, and the right testicle was not palpated. The tentative diagnosis, right direct inguinal hernia, with undescended testis, was made.

Accordingly, on June 21, an incision was made over the right inguinal region, disclosing a distinct sac, at the back of which were found rudimentary elements of the cord. The vas was followed down to the undeveloped testis. A reducible mass which, previous to operation, had been thought to be the undescended testis, was now found to be the cæcum, appendix, the entrance of the ileum into the cæcum, and the tumor mass within the cæcum, in the neighborhood of the base of the appendix. Manipulation failed to dislodge it. In the mesentery of the appendix and in the ileocæcal angle, several large, moderately hard lymph-nodes were felt. As it was thought the mass was a neoplasm, the wound was closed in the usual manner for the Bassini operation.

A right rectus incision was made. After opening the abdomen, the intestine, cæcum and ascending colon were examined. The cæcum, colon, and four inches of the small intestine were mobilized, and a resection of this part of the gut was done by the aid of clamps. The divided ends were sutured and inverted with chromic catgut, and further invaginated with a purse-string suture of Pagenstecher. A lateral anastomosis between the terminal ileum and the colon was effected, and the retroperitoneal bed covered, as far as possible, by drawing the leaves of the mesentery together. The wound was closed and drained, and a dry dressing applied.

His recovery was uneventful. The day after operation he voided voluntarily. Seven days post-operative his bowels moved naturally. On the fourteenth day he was up, "feeling fine." On July 10 he was discharged home, to report to the Out-Patient Department for the removal of the straps.

On November 21, 1916, just seventeen months post-operative, he returned to the Follow-up Clinic. An unsuccessful attempt had previously been made to find the man. He is entirely without pain, has

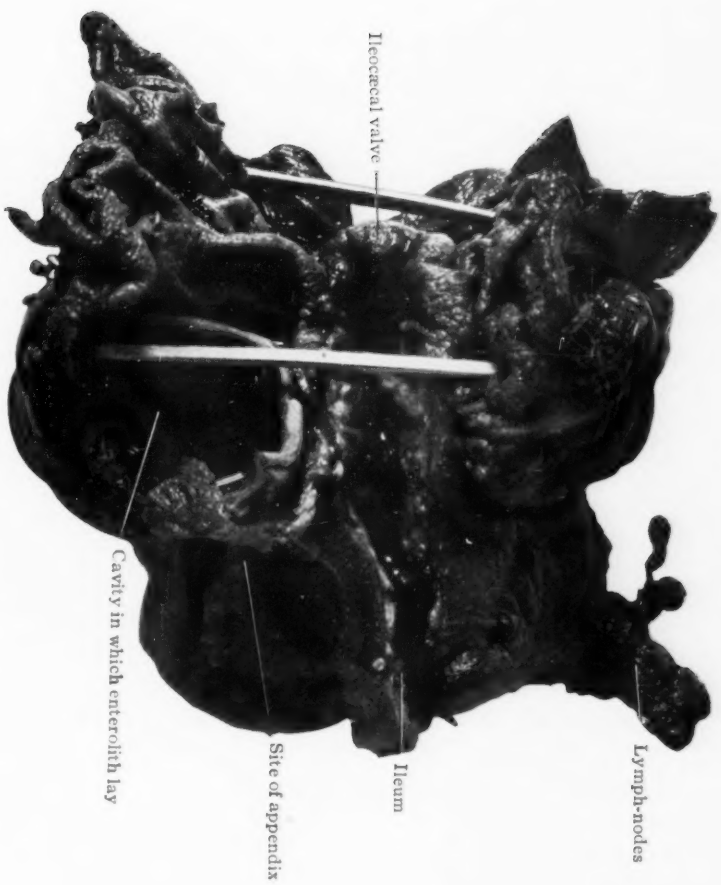
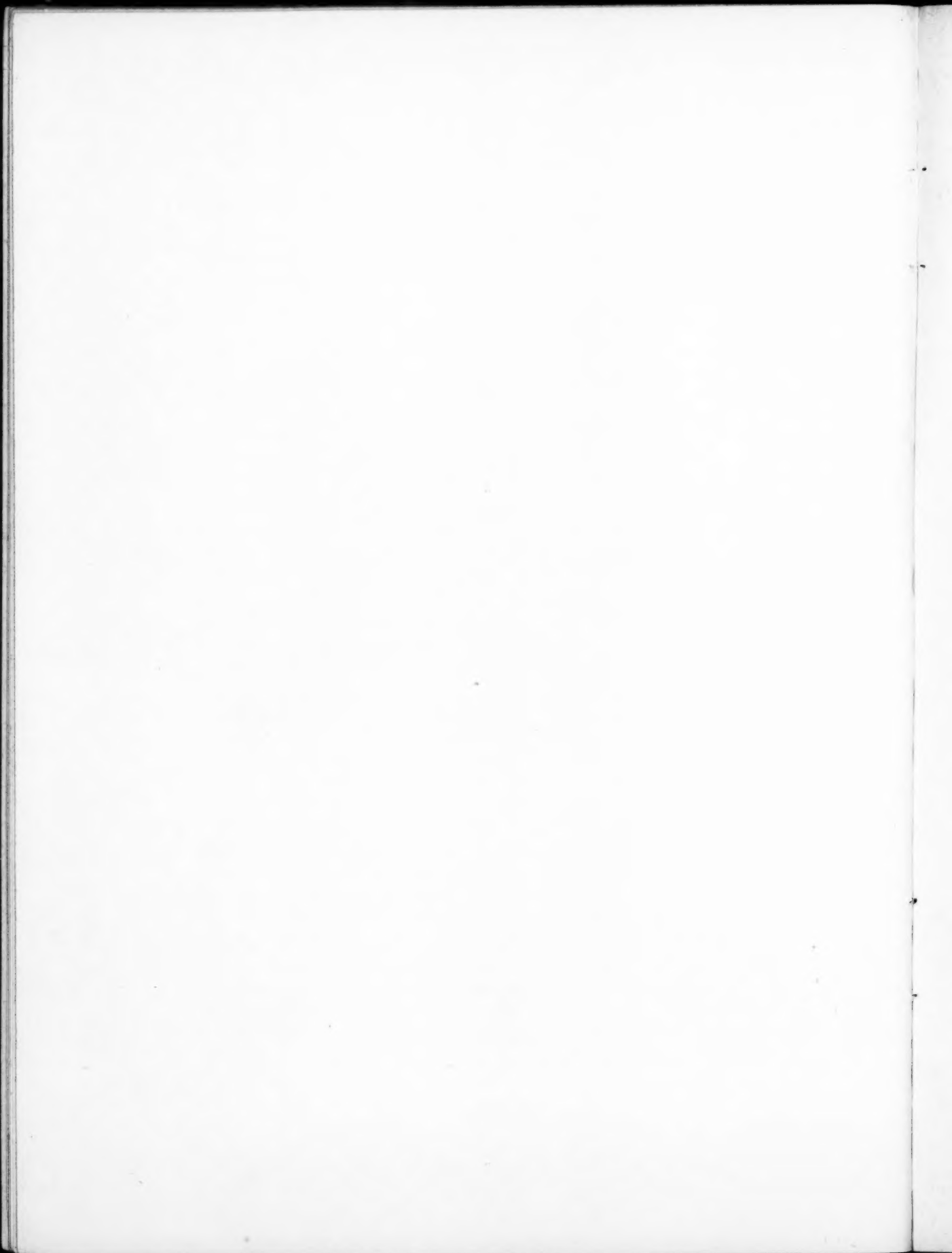


FIG. 4.—Diverticulum of caecum containing enterolith.



RESECTION OF CÆCUM AND ASCENDING COLON

no disturbance of function, except that occasionally he is constipated and takes a cathartic. His appetite, sleep and strength are all good. His weight is 145 pounds, an increase of five pounds. His strength, he says, is twice as great as before operation. He resumed work two months after operation, and his earning capacity is 100 per cent. of what it has ever been. Physical examination shows inguinal wound firm. Abdominal wound also firm, with very slight pain on deep palpation of right side. No masses felt.

The resection of the cæcum and ascending colon was done through a rather small wound. It was easy because of the very marked mobility of this portion of the bowel as it had descended into the scrotum. The pathological report of Dr. Morris is as follows:

Specimen (Fig. 4) consists of lower end of small intestine 6 cm. in length and the adjacent portion of the cæcum. The specimen had been put in formalin before examination in the laboratory. The wall of the intestine is somewhat hypertrophied. The lumen is contracted. The mucosa is markedly wrinkled and stained with greenish bile. The ileocæcal valve is narrow, and the mucous membrane of the cæcum surrounding the ileocæcal valve is greatly hypertrophied in one portion, forming a teat-like mass, say 1 cm. The appendix is 6 cm. in length, normal in size. The lumen admits readily a probe. The mesentery is short and fatty. Between the apparent opening of the appendix and the cæcum there is a large round cavity which is filled with a formed mass of fæces. The fecal mass appears through the narrow opening into the cæcum of this cavity which is formed by the wall of the cæcum. It is somewhat difficult to tell if the cavity wall was originally a part of the appendix, or if the cæcum itself has played a part in the formation of the cavity. The opening into the cæcum is about 24 mm. in length by less in breadth. The circumference of the cavity in the widest portion is about 6 cm. and the distance from the apparent opening of the appendix to the valve-like opening is about 3 cm. The edges of the cavity are formed by what appear to be separated mucous membrane. The mesentery is fatty, and there are a number of enlarged ileocolic lymph-nodes. The mucous membrane of the cæcum is hyperplastic, but without ulceration or hemorrhages.

Anatomical Diagnosis.—Large (chicken egg) enterolith of cæcum with ball valve formed of mucous membrane at origin of appendix.

The specimen has been pretty badly mutilated. That this was an enterolith of the appendix, a very common condition, can be disproved by inspecting the specimen. If the tænia of the large bowel be followed down, they will be seen to terminate at the base of the appendix.

The pocket in which the "enterolith" lay was proximal to the termination of the tænia striæ, being formed in the greater part of its extent by a sacculæ which forms the caput coli, *i.e.*, this sacculæ lying between the anterior band and posterolateral band. The remainder of the pocket was formed by the left sacculæ, greatly diminished in size, which lies anatomically between the anterior tænia and on the posterior internal tænia. We must consider that portion of the bowel the large intestine which has tænia still arranged in bands, and must denominate that portion *appendix* where the bands are no longer discernible as entities. If we agree to the foregoing, we will see that the "enterolith" was lying in the terminal sacculæ to the right of the anterior band. The mesenteric glands can be seen in the picture. I may say that the microscopic examination of these discloses no pathological condition.

HYPERNEPHROMA WITH ABDOMINAL NEPHRECTOMY

DR. ROGERS presented a man whom he saw during the first week of July, 1916, with a history of very rapid loss of flesh and strength and with no other symptoms. There had been a decrease in weight during the last three months of thirty pounds. The urinary examination was negative. A physical examination revealed a considerable tumor in the right kidney region about six inches in diameter. Examination of the urine showed no abnormality but ureteral catheterization demonstrated that no urine was coming from the right ureter. The most probable diagnosis was hypernephroma. As the abdominal wall was thin and the tumor was apparently most accessible from the front, an anterior nephrectomy was chosen. On July 6, at St. Francis Hospital, the tumor was exposed by a vertical incision along the outer border of the right rectus muscle of about eight inches in length. Then very many extremely large veins were found over the surface of the tumor, which were divided between double ligatures.

After the retroperitoneal area was entered along the outer border of the ascending colon, to obtain better exposure, it became necessary to enlarge the vertical wound by a transverse incision on either side across the right rectus and well into the lumbar region. This allowed the veins to be divided between double ligatures, and in the course of these procedures a very large vein was found extending obliquely along the inner border and somewhat in front of the tumor. After some further dissection it was found that this was probably the inferior vena cava. Examination then showed that the tumor had absorbed the right renal vein and projected directly into the interior of the inferior vena cava. Any attempt to remove such a tumor from the usual posterior lumbar incision, would probably have resulted disastrously.

ACUTE HEMORRHAGIC PANCREATITIS

A long curved clamp with the blades protected by rubber tubing was placed laterally on the vein and the tumor with the portion which entered the vena cava removed. The wound in the vena cava was closed by a suture and the clamp removed. The abdominal wound was closed in layers without drainage, and the recovery was entirely uneventful, and the patient left the hospital at the end of three weeks.

In spite of the large crucial incision there has been no hernia and the abdominal wall is as sound as can be.

After this operation the reporter did not see the patient until the middle of October. He then told him that before he left the hospital he felt in his parotid gland a small swelling which apparently had escaped the observation of those in charge. When he appeared in October the swelling in the left parotid was very firm, scarcely movable and extended quite deeply under the angle of the jaw. It did not seem worth while at that time to attempt further operations. Therefore he advised the application of radium, which was done by Dr. Janeway in the General Memorial Hospital on October 18. Since that application the swelling has decreased very perceptibly in size. There was a very severe reaction at the time with a great deal of swelling and inability to open the jaw. Now the mouth can be opened at least a half inch more than it could before the application of the radium. Dr. Janeway, before applying the radium, excised a fragment of this tumor tissue which was later reported to show the characteristics of a hypernephroma.

PINNING OF FRACTURE OF RADIUS

DR. MORRIS presented a boy who had a fracture of the radius-ulna which is being held with a pin in the radius. The fragments could not be held with ordinary splints. The pin was introduced through a small incision while the bone was visualized behind a fluoroscopic screen.

ADEQUATE DRAINAGE IN OPERATIONS FOR ACUTE PANCREATITIS

DR. FORBES HAWKES read a paper with the above title.

ACUTE HEMORRHAGIC PANCREATITIS

DR. POOL presented a woman, nineteen years of age, who was admitted to the New York Hospital thirty-seven days ago, with the following history:

She suffered from acute abdominal pains which started forty-eight hours previously as generalized abdominal pains sharp and cutting in character. She vomited once, a large amount of yellow fluid. There had been no bowel movement in two and one-half days.

Six months previously, while patient was in the fifth month of an otherwise normal pregnancy, she had severe abdominal pains which were treated by morphine.

Three weeks before admission she had "gall-stone colic" with pains in right upper quadrant and right shoulder. During this attack she had jaundice and clay-colored stools. On admission physical examination showed a well nourished young woman in marked abdominal pain. Pulse was very rapid and of rather a poor quality. Temperature and leucocyte count moderately elevated. Abdomen distended and rigid throughout.

There was a marked tenderness over the regions corresponding to a low gall-bladder and high appendix, also on left side corresponding to tail of pancreas.

The flanks were tympanitic. Patient was not cold; not sweaty; not cyanotic; not in a marked degree of shock which we usually associate with acute pancreatitis. As the patient had been sick forty-eight hours and was not in a condition of shock, this diagnosis was not considered probable. The diagnosis was acute peritonitis, cause—cholecystitis, possibly appendicitis, but the condition seemed atypical of either.

Operation.—Right rectus incision so as to explore gall-bladder and appendix. Appendix normal. No stone in gall-bladder and the gall-bladder was not distended. The peritoneal cavity contained considerable thin, cherry-red fluid. There were areas about 5 mm. in diameter of fat necrosis over quite a diffuse area of the peritoneum. The pancreas could be felt as an extremely hard mass, the head being as large as a man's fist and the body as large as the wrist. The transverse mesocolon was made taut by lifting the transverse colon and greater omentum and the cedematous thickened layer over the pancreas was opened about 3 inches and the pancreas was penetrated with closed scissors along its length as far as possible, the scissors being opened vertically so as to tear the pancreas and establish some drainage. (The patient's condition did not seem to warrant a more elaborate operative procedure than this rapid drainage through the most accessible route.) Two large cigarette drains and a rubber tube were then introduced into this pancreatic retroperitoneal space and all the drains were surrounded by a rubber dam, the lower edges of which were tucked into this space. The drains as a whole were about two inches in diameter.

The condition of the patient did not warrant further exploration of the biliary tracts nor drainage of the gall-bladder which did not seem imperative. Drainage was profuse. Thirteen days after operation there began a profuse bile discharge from wound which persisted for

ACUTE SUPPURATIVE PANCREATITIS

two weeks. Three weeks after operation wound had become infected with *B. pyocyaneus*; wound irrigated with one per cent. acetic acid in normal salt solution; and wet pads of same applied locally. Pyocyaneus infection disappeared rapidly. Patient was up and about the ward less than five weeks after operation. Discharge entirely ceased at this time.

There never has been any glycosuria; bile was present in urine for a time. Examination of stools November 21 showed an absence of bile.

ACUTE SUPPURATIVE PANCREATITIS

DR. NATHAN W. GREEN presented a woman sixty-four years of age, a patient of Dr. E. W. Gould, who was admitted to the Surgical Service of St. Luke's Hospital, May 26, 1913, at 9.40 P.M.

Her history upon admission was that of pain in the upper abdomen. Her present illness commenced four days previous to admission, when she began to have pain in the abdomen, especially marked in the pit of the stomach. This remained constant up to the time of admission. She had slight fever and vomited once. Bowels have been constipated.

Her past history shows that she had "gastric dyspepsia" for years, but never vomited any blood or passed any by rectum. She had a similar attack to this ten years ago without operation. She has had several children. Her history aside from the foregoing was irrelevant.

Physical examination revealed the following: The patient on admission looked acutely ill. There appeared to be some fever and a pinched expression of the face. Pulse was 85 per minute and of fair force. Examination of her eyes and chest showed nothing strikingly abnormal. Her abdomen was obese, but there was no distention. There were pain and tenderness in the epigastrium, right and left of the middle line. There did not seem to be much rigidity, nor was there tenderness over McBurney's point, nor was there anything definite in the gall-bladder region. Her extremities were normal.

Owing to her pain and tenderness in the epigastric region and to her appearance of being acutely ill, an exploratory operation was thought advisable, and this was performed at one o'clock in the morning of May 27.

Operation.—Dr. Green. Anæsthetic, gas and ether by Dr. Stout. The operation consisted of an exploratory incision and drainage through the lesser omentum down to the pancreas.

Pathological Findings.—The gastrohepatic omentum was adherent to the posterior abdominal wall occluding the foramen of Winslow. The head and body of the pancreas were large and hard, and several drops of pus were seen on the anterior surface of the head (the pancreas

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felt like a triangular ear of corn extending from right to left across the upper abdomen).

Operative Procedure.—The incision was made through the right rectus muscle. The gastrohepatic omentum was opened and a drain inserted down to the head of the pancreas. The pancreas was not incised. The abdominal wall was then closed by layers, except for a rubber tube and gauze drain. The temperature at the time of operation was 100° F.

After the operation the patient complained of great pain for several days. This was controlled by morphine. There was drainage through and at the side of the tube for several days, but, as the wound was kept protected by alboline, there was but little excoriation. She continued to have some pain a month after the operation, and it is recorded in the bedside notes that she vomited on five days at this time and again later, on several occasions. She was discharged cured on July 25, 1913. There is no record of sugar in her urine, and a recent examination shows no reduction by it of Fehling's solution.

DR. CHARLES H. PECK presented a woman, thirty-five years of age, who was operated upon two years ago for supposed acute cholecystitis. The gall-bladder was acutely inflamed and contained calculi. In addition there was a large abscess of the head of the pancreas. After performing cholecystostomy, the abscess was opened by incising the overlying peritoneum and forcing blunt forceps into the mass. A considerable quantity of pus was evacuated; the opening was made above the transverse colon.

The cavity was sponged out and a good sized drain placed down to it. Another was carried down below the gall-bladder and the wound closed. The patient made a rather stormy convalescence, but recovery continued steadily. The wound continued to drain and she left the hospital on June 5, with wound still draining. The drainage seemed to contain some pancreatic fluid and she was referred to the Out-patient Department, where she was under the care of Dr. Stillman for some months.

It took nine months for it to close completely and in the interval necrotic pieces of tissue would escape which were probably pieces of sloughing pancreas. There is nothing of particular interest in the convalescence since then, except that she has continued in good health and has had no evidence of sugar in the urine at the time nor during her convalescence.

She has a rather weak spot in the cicatrix but no true hernia, and complains of some pain there.

ACUTE SUPPURATIVE PANCREATITIS

DR. POOL said with regard to drainage, he thought that possibly Dr. Hawkes recommends too little drainage in the mild cases and too much in the severe and advanced cases. In cases of acute pancreatitis simply to put drainage down to the peritoneum over the pancreas appears insufficient because, if necrosis of the pancreas is present and advancing pressure should be relieved, such a procedure does not relieve pressure.

In the severe cases he did not think one has to drain the peritoneal cavity at several sites, but should establish adequate retroperitoneal drainage from the pancreas itself. In some cases, as in the one presented by him, this apparently may be done to advantage through the mesocolon. In this case a right rectus incision had been made, as is frequently done, under the impression that the lesion is cholecystitis or appendicitis. Through this incision ready access to the pancreas through the gastrocolic omentum may not be obtainable, whereas the pancreas, especially its head, part of which lies on a plane below the attachment of the mesocolon, may be easily reached through the transverse mesocolon. With the right rectus incision drains pass obliquely outward and downward from this site and are not interfered with by the great omentum, as they would be if they were introduced through a median incision.

DR. ROBERT T. MORRIS said that Dr. Pool's experience had been exactly his own and his view in the matter in regard to drainage is much the same. It seemed to him that in the mild cases one may not always know whether they are going to become more severe. He had in mind one case in which he did not incise the pancreas, that subsequently sloughed. So far as he could observe the entire pancreas came out through the incision and the patient recovered and lived for a year or two before dying of diabetes. Incisions into the pancreas might have saved it.

DR. LUCIUS W. HOTCHKISS remarked that he had had a number of these cases, and had been impressed with the fact that they fall, roughly, into three classes: The hyperacute hemorrhagic pancreatitis, all of which die; the acute suppurative pancreatitis, so-called, in which an operation may be effectual; then the so-called acute cases which are really subacute and in which surgery is very often effectual.

His first case of this type he saw several years ago: A woman who had been seized with severe abdominal pains and sent to the hospital where the examination showed abdominal pain, fever, and distention. He opened the abdomen and discovered, scattered about, many small fat necroses. He had never seen a fat necrosis before.

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The abdomen was washed out and closed and the patient recovered. In that case the pancreas was not felt.

In the other cases he had had, he had generally drained through the gastrohepatic omentum, occasionally through the gastrocolic omentum. He believed it to be desirable, if possible, to split the peritoneum overlying the pancreas.

One extraordinary case which he had reported to the American Surgical Association was first drained, then the first incision was enlarged; then a secondary drainage opening was made through the right loin and penetrating into lesser peritoneal sac. Then finally a perforation of the posterior stomach wall occurred, probably pancreatic digestion, and after suturing this the patient recovered.

Most of the cases have occurred in obese alcoholic men or very fat women. One notable case was at the Bellevue Hospital about two years ago—a very fat woman in which anterior drainage through the gastrocolic omentum was used. The patient had practically recovered, sat up in a chair and was about the ward, when she had a sudden relapse and died.

It had been his fortune to see quite a number of these very interesting and very unusual cases. The most striking thing about the hyperacute hemorrhagic pancreatitis is the one described as typical, viz.: they all have died within forty-eight hours. A case of that type must die because destruction is so intense it makes no difference what one does. In other types definite and adequate drainage may accomplish much.

DR. CHARLES H. PECK said that he had a second case of acute pancreatitis shortly after the one he presented to-night. In this man a transverse tumor could be felt across the abdomen, as he was not very stout.

They did not know what the trouble was, but during the exploratory operation it proved to be a greatly swollen pancreas, three or four times its normal size. The easiest way of approach was through the gastrocolic omentum, between the stomach and the transverse colon, and it was drained that way. He pushed a blunt instrument into its substance at a number of places, drained down to the surface of the pancreas, and the man recovered.

In the first case the swelling was over the head and they approached it from the right side below the stomach. The abscess was opened below the stomach and above the transverse colon. The point that Dr. Hotchkiss brought up was a good one, that in pancreatitis all degrees of involvement are met with from the most acute types to the

ACUTE SUPPURATIVE PANCREATITIS

most chronic ones. The very violent ones go on to rapid necrosis and die almost always. He had had two of that type that died very promptly after operation. He saw one unoperated patient die and on examination there was found complete gangrene of the organ. Then, a type such as the second case he referred to, can fairly be classed as acute though they approach the subacute type.

He had two cases in mind, one in the hospital now and one operated upon two years ago, in which the swelling of the pancreas was so great that it was difficult to know whether to class as a chronic or as a mild degree of acute pancreatitis.

It seems to him one can see a whole series from the very acute fulminating type down to the real hard chronic type, and in that series almost any degree of acuteness in the process. It is important, where it approaches the acute, to incise the peritoneum over the pancreas and secure drainage by pushing the finger or blunt instrument into the substance of the pancreas.

He had never felt it necessary to drain the pelvis or lumbar gutter.

DR. FRANZ TOREK called attention to one case which he drained exclusively from the dorsal region. That was a case in which he had made the diagnosis beforehand, which is out of the ordinary. He proceeded by making an exploratory abdominal incision and found the tail of the pancreas greatly swollen and œdematous.

With one hand in the abdomen on the tail of the pancreas and the other hand outside on the back he made a comparatively small incision (large enough for two good-sized drainage tubes) down to the pancreas, perforated its posterior wall, took out the pus and introduced the drainage tubes. The patient made a very smooth recovery. This is the only case that he had drained from the posterior route. He described this case and some other cases of pancreatitis eight years ago.

DR. ALEXIS V. MOSHCOWITZ said that the method of approach should be selected to fit each particular case of pancreatitis. In some cases the approach through the gastrohepatic omentum is indicated; in others that through the transverse mesocolon. In a number of cases Dr. Moshcowitz had exposed the pancreas between the stomach and the transverse colon, and he has been so satisfied with the method, that he avails himself of this opportunity to recommend it. Particularly in very fat individuals this method is somewhat more difficult, but the after-treatment is superior and infinitely simpler, as it affords a direct method of drainage, without any of the inconveniences of kinking the tube, as might happen in draining through the gastrohepatic omentum, or kinking the transverse colon in draining through the transverse mesocolon.

CORRESPONDENCE

THE KERR SUTURE

EDITOR OF ANNALS OF SURGERY:

The January ANNALS contains a splendid article on "Temporary Colostomy," by Shaw and Hunt, in which the authors refer more than once to "the Kerr suture." The illustrations show that they are speaking of the suture used in a new method of intestinal anastomosis evolved by Dr. Edward Mason Parker and Dr. Harry Kerr, and described by them in the *Johns Hopkins Bulletin*, vol. xix, No. 206, May, 1908. This is generally known as the "Parker-Kerr suture"; it is so described in Moynihan's "Abdominal Operations," 3d ed., vol. i, p. 306, and in the literature generally, including Dr. Kerr's own publications.

JOHN A. FOOTE.

WASHINGTON, D. C., January 24, 1917.

OMISSION

To the name of the author of the paper on "The Cœliac Artery," February ANNALS, p. 159, Benjamin Lipshutz, M.D., should have been added the words: Corinna Borden Keen Research Fellow of the Jefferson Medical College.

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